Electrical Review

With Which Is Consolidated WESTERN ELECTRICIAN and ELECTROCRAFT.

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General View of About One-half of the Present Quarry Workings at Thornton.

Electricity in World's Largest Stone-Crushing Plant

Motor-Driven Machines Are Used Throughout, the Total Lighting and Power Load Being in Excess of 1,000 Kilowatts —Plant Has Capacity of 8,000 Cubic Yards Per Day

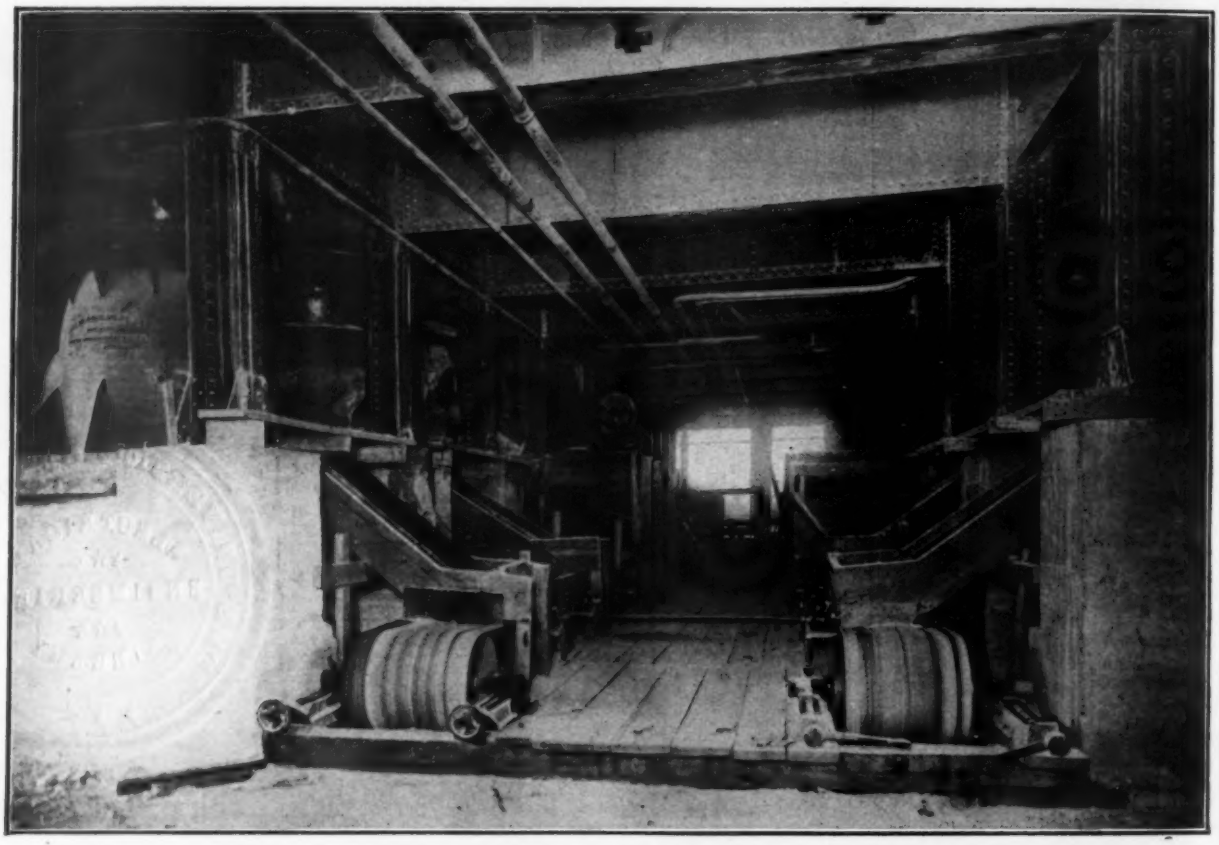
ELECTRICITY plays an important part in the operation of the rock-crushing and screening plant of the Brownell Improvement Company, at Thornton, Ill., 30 miles south of Chicago. The plant's capacity is about 8000 cubic yards per day and is the largest of its kind in existence. The material consists of a hard, fine-textured limestone, having no overburden, and which is quarried to a depth of about 40 feet, from a pit about 2500 feet square. Trackage in the pit extends completely around it, next to the outer rim, and also to a circular-shaped area in the center which has not been quarried down to the level of the rest of the pit. Close to the eastern border of the pit is a basin about 125 by 150 feet, which 20 to 30 years ago was excavated to a depth of 40 feet below what is now the main pit level; this basin is kept nearly filled with water, the sources of which are springs in the vicinity. Two centrifugal pumps, of 2400-gallons and 2300-gallons capacity, respectively, each driven by a 75-horsepower motor, are stationed at the brink of this basin to pump water to the condenser in the power station, to the boiler room, and for general purposes.

The rock is broken in the pit by blasting with dynamite. Six-inch holes are driven vertically to a depth of 45 to 50 feet, by Loomis motor-driven drills, made by Loomis Machine Company, Tiffin, Ohio, eleven such drills being in use. Each drill is operated by an 11-horsepower motor, current for same being transmitted by duplex, covered wires from the generating station. About 100 such holes are driven, 18 to 20 feet apart. A charge of dynamite is placed in the bottom of each hole, with cap adjusted and connection made to an electric wire; the hole is filled half way, and another dynamite charge is similarly placed about midway between the bottom and the surface. When all is in readiness, 100 holes are simultaneously shot off by electricity from an alternating current circuit. The rock thus broken is loaded into Griffin Wheel Company 8-yard cars by Bucyrus 3½-yard steam shovels of which there are seven in the pit; the loaded cars are hauled by American Locomotive Works 30-ton steam locomotives to the east side of the pit, where inclined tracks run about 100 feet, at a 40-degree angle, to the initial bins and crusher outside the pit. Beginning with car-haulage up the in-

cline, all operations throughout the plant are by means of electric power.

Power Stations.

Power generation is centered in a boiler house and a steam-electric station. There are three 500-horsepower, coal-fired, Milne boilers. The generating station contains an Allis-Chalmers steam turbine, rated at 1500 horsepower, speed of 3600 revolutions per minute; this is direct-connected to a 1000-kilowatt, alternating-current generator, rated at 480-volts, 3-phase, 60-cycles, 3600-revolutions per minute. Accessory to this is a direct-connected exciter for starting. In addition to the main station is a small substation plant, adjoining the boiler house, where an Ideal compound, tandem engine drives a 125-kilovolt-ampere, three-phase, 60-cycle, 440-volt, alternating-current machine. Power from this generator is utilized as reserve force, and for driving the 11 drill motors. Lighting service is supplied from a 19-kilowatt, direct-current, 110-volt dynamo, driven by an alternating-current motor. The 11 circuits for drill operating are carried to the pit part way by underground conduits.



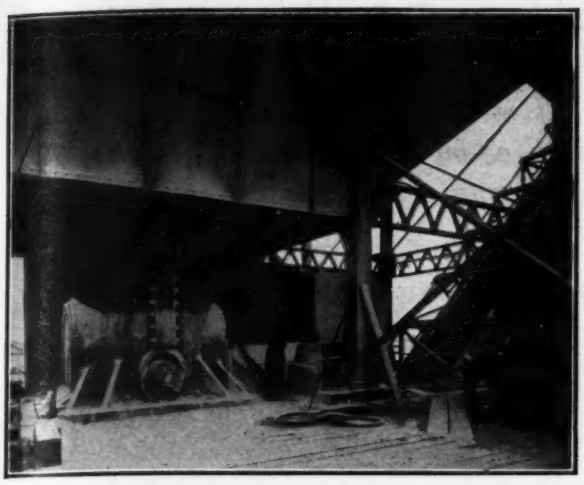
Battery of No. 6 Motor-Driven Crushers With 30-Inch Conveyors in Foreground.

Coarse Crushing.

The two inclined tracks, over which cars of ore are pulled out of the pit to the crushing plant, terminate in automatic dumping devices above the crusher bins. The track terminals are supported by a double tower structure, containing two winding sheaves, one for each incline. Near the base of the tower structure are two small buildings, each containing an Allis-Chalmers winding hoist, operated by gear connections to a 100-horsepower motor. A 1¼-inch steel-stranded cable, attached to the hoist, runs up over the winding sheave in the tower, thence to the dump cars that operate on the incline. The hoisting operations are directed by two operators from two controlling stations in the double tower, each one by means of a drum-type controller made by Cutler-Hammer Manufacturing Company. With this equipment close to 1000 cars of rock per day are pulled out of the pit and dumped into the crusher bins. These hopper-shaped bins feed direct into a No. 24 Allis-Chalmers gyratory crusher, operated by a 200-horsepower motor, the power being transmitted by 12 single-rope drives. The rock, after passing the big crusher, has a maximum size of about 5 inches. It is carried from the crusher pit by a pan-conveyor to the top of the main mill building, the conveyor being operated by a 200-horsepower motor. The conveyor discharges upon a large grizzly. The fines passing the grizzly drop into a bin, and are carried thence by belt conveyor to revolving screens; the grizzly oversize rock is recrushed by four No. 7½ Allis-Chalmers crushers, these being operated by two 100-horsepower motors through belt drives—one motor serving two crushers.

Fine Crushing and Screening.

The crushed rock from the four No. 7½ crushers is classified by two sets of revolving screens on the same floor, each set of two screens being run by a 100-horsepower motor, belt-connected. The screen fines are re-classified in other finer screens, and the oversize drops into bins and is then recrushed. Stationed upon a deck above the second floor are five 100-horsepower motors, by which ten sets of rotary screens are operated through belt connections on this



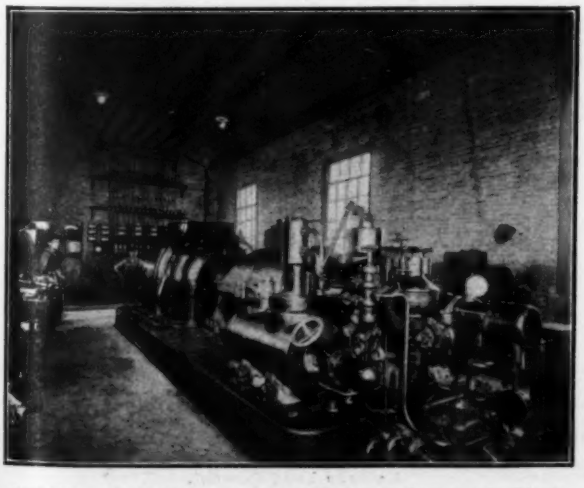
Lower Section of the Allis-Chalmers No. 4 Gyratory Crusher.

floor. The coarse or screen oversize from the ten screens passes by belt conveyor into bins, from which it is fed into eight Allis-Chalmers No. 4 crushers for further reduction, one 50-horsepower motor serving each two crushers in the battery of eight. The fines, or screen undersize, are further classified over ten shaking screens, all operated by the motors above mentioned. The crushed rock from the No. 4 crushers is screened and classified in the same manner. In the west end of the building are bins containing crushed rock from other crushing units. This is re-crushed by eight crushers, four on each side; there is one 75-horsepower motor for each two crushers, a No. 6 and a No. 4. The last crushing and final classification give coarse grades from 2¾-inch to ¼-inch, and fines classified as to various meshes. The finished products are finally elevated and passed through fine revolving and shaking screens, thence into the shipping bins.

Current from the generator room is conducted to the four distribution panels in the mill through metal conduits. One panel serves the 100-horsepower motors, and others in like manner serve motors of other rated capacities. There are 43 motor installations at the plant, of a combined capacity of 2453 horsepower. The power consumed amounts to 8500 kilowatt-hours per day, based on 10-hour service. The motors are all Allis-Chalmers installations, as are also all crushers, pan-conveyors and hoists. The large amount of belting supplied was partly by Revere Rubber Company and partly by Republic Rubber Company; and the belt conveyors by Stephens-Adamson Manufacturing Company, Aurora, Ill.

A system devised by E. H. Miller, electrician for the company, automatically to count and record the number of cars hoisted from the pit, has proved efficient and satisfactory. The count is registered in the office by a Durant magnet, connected by wires to devices at the two hoists.

The present plant was built in recent years but the quarry has been active over 30 years. The chief market for this crushed rock, for concrete construction, is found in the city of Chicago. W. J. Black is general manager, J. G. Black being superintendent. Col. Jefferson Hodgkins is president of the company.

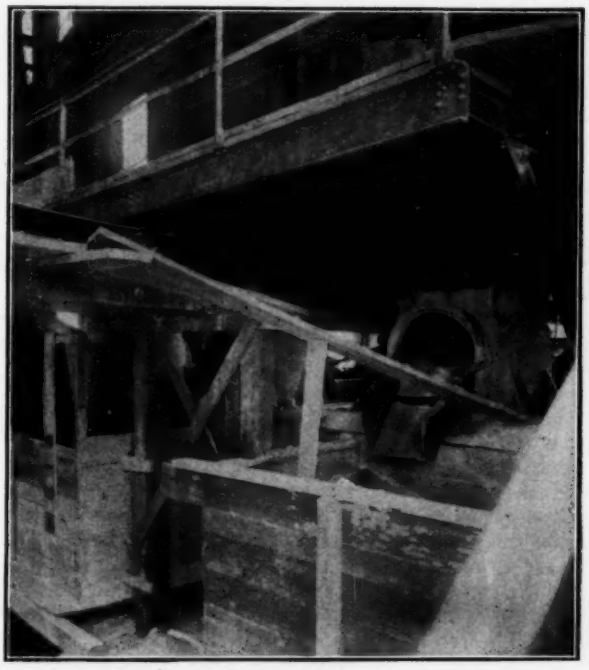


1000-Kilowatt Turbogenerator at Brownell Company's Plant.

Water Power in the French Alps.

Prof. R. Blanchard, in a paper in the *Annales de Geographie,* takes stock of the present position in the development of water power in the French Alps. Between 1903 and 1916 the total horsepower supplied by the waters of Haute-Savoie, Savoie, and Isere rose from 145,000 to 528,000. In Haute-Savoie the means of communication are difficult, and the power generated is in great part transmitted to workshops outside the mountains. In Savoie there are excellent means of communication, but local differences in the slope and form of the valleys result in irregular distribution of the workshops, which tend to congregate in certain localities, such as the courses of the Arve and Bonnant near their junction.

The interior valleys show the greatest advance of all—an increase of 74 per cent between 1910 and 1916—and use more than half the total horsepower generated in the region. The Southern Alps suffer from deficiency and irregularity of water supply, and the absence of glaciation renders the forms of the valleys less favorable; but some progress has been made along the middle course of the Durance and in the Maritime Alps.



Lower Part of One of the No. 7½ Crushers Discharging Into Bin.

Iron Wire for Short High-Voltage Lines

Economy Dictates Consideration of Iron Wire for Transmission Purposes—Characteristics of Iron Wire on Alternating-Current Lines—Suitability for Light Loads and Fairly Short Lines

By W. T. RYAN

Assistant Professor of Electrical Engineering, University of Minnesota.

MAINLY as a consequence of war prices the initial investment required for copper conductors has risen to a point where many operating companies have found it necessary to consider the use of iron wires for the transmission and distribution of electric power. A No. 6 B. & S. gauge copper wire is the smallest size that is ordinarily used on any transmission line for mechanical reasons. Three No. 6 wires 10 miles long, at 40 cents a pound, will cost $5,028. Three No. 6 iron wires 10 miles long will cost less than $1,000. Forty kilowatts at 13,200 volts means less than two amperes in a three-phase line. If No. 6 copper wires are used, the loss will be approximately 25 watts per mile of line or only 250 watts on a 10-mile line. The alternating-current resistance with two amperes at 60 cycles in No. 6 B. B. solid galvanized iron wire is about 12 ohms per mile. Even this high a resistance means a loss of less than 150 watts per mile or 1,500 watts on a 10-mile line. This is a line loss of only 3.75 per cent.

The relative advantages, from the standpoint of economy, of iron and copper on alternating-current lines are difficult to determine because the alternating-current resistance of iron conductors varies widely with the current and with the grade and make-up of the wire. The alternating-current resistance of a conductor depends upon its magnetic properties, and as a general rule the better the iron the more the resistance will vary with the current density because of the higher magnetic permeability of the higher grade iron. The resistance of a No. 6 copper wire is almost exactly the same with one ampere of 60-cycle alternating current flowing through it as it is with 5 or 50 amperes. The resistance as measured with direct current of a No. 6 E. B. B. solid iron wire is 8.0 ohms per mile. The resistance with 7 amperes 60-cycle current is 20 ohms, a rise of 150 per cent. For still larger currents the resistance falls off slightly. The direct-current resistance of No. 6 B. B. solid wire is 9.6 ohms. The alternating-current resistance with 12 amperes 60-cycle current is 18.8 ohms, a rise of 96 per cent. The alternating-current resistance of a 5/16-inch, seven-stranded, galvanized steel cable is only 20 per cent higher with 15 amperes 60-cycle current than it is with direct current.

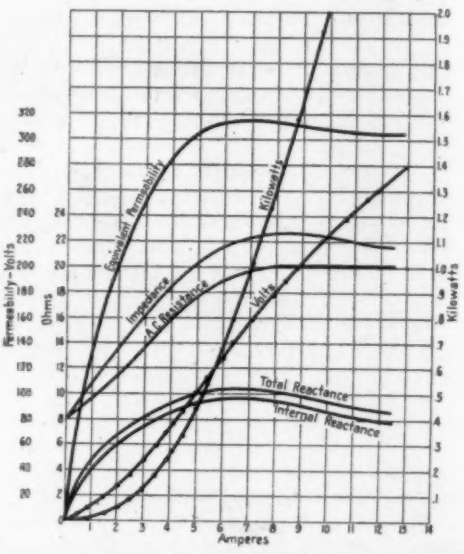


Fig. 2.—Constants Per Mile of No. 6 EBB Galvanized-Iron Wire for Flandreau-Elkton Line.

The price of copper has now risen to such a point that the economical advantages of iron wires for short high-voltage lines are receiving more careful consideration. Iron wire is, of course, much better from a mechanical standpoint but at a great disadvantage as regards conductivity and durability. The internal inductive reactance of iron wire is many times that of copper. This is not a serious consideration on very short lines. On lines that would be considered long

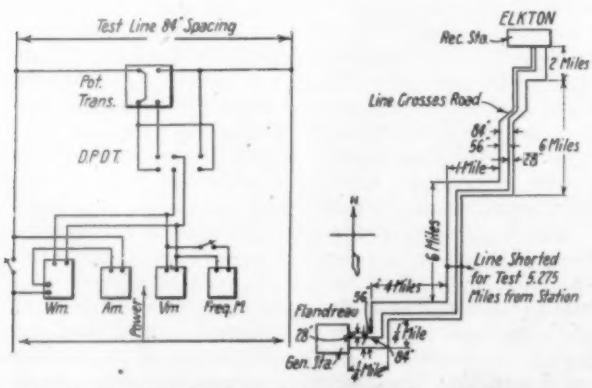


Fig. 1.—Connections of Test Instruments and Diagram of Flandreau-Elkton Test Line.

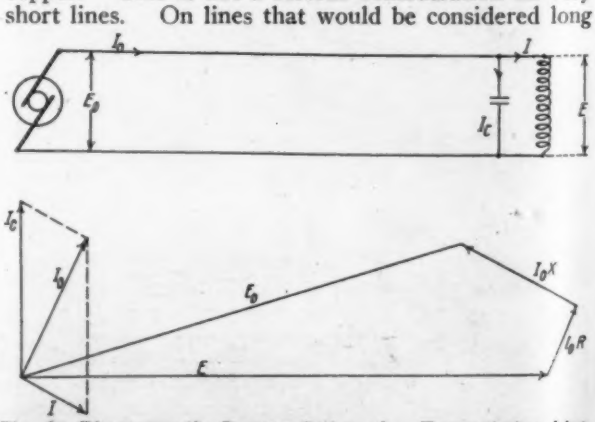


Fig. 3.—Diagrammatic Representation of a Transmission Line and of Line Relations When Charging Current Exceeds Load Current.

for iron-wire lines and with higher voltages this factor may involve serious variations in the voltage.

The results of tests of the electrical and magnetic properties of iron and steel wires are just beginning to be published. Some very excellent tests were made

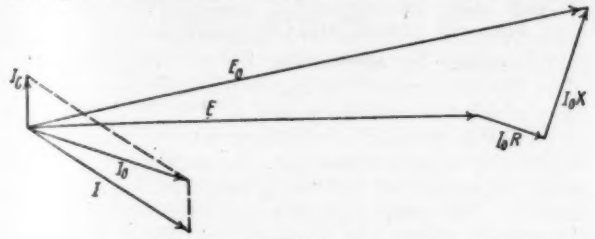


Fig. 4.—Diagram of Line Relations When Load Current Exceeds Charging Current.

last year by Charles E. Oakes and Winfield Eckley at Oregon Agricultural College, and a number of tests were made at the University of Minnesota by two of our post-graduate students, A. H. Abbott and R. I. Butterworth. These included a test on the iron wire line between Flandreau and Elkton, South Dakota.

Test of the Flandreau-Elkton Transmission Line.

The Dakota Light & Power Company has been building iron-wire transmission lines for the past two years, and its load over the Flandreau-Elkton line was about to be increased to a point where the company was doubtful if the iron-wire line would take care of it. At the request of Mr. Savage, treasurer of the company, Messrs. Abbott and Butterworth undertook to make impedance and line-loss tests of this No. 6 E. B. B. galvanized-iron wire, 13,200-volt line.

Fig. 1 shows the layout of the transmission line, and also the diagram of connections for the test instruments used. From a previous test of No. 6 E. B. B. iron wire, Messrs. Abbott and Butterworth were able to estimate with a fair degree of accuracy the quantities of current, voltage, and power they would have to measure on about five miles of the line, and hence they knew just what range of instruments would be required. The line was made clear at the far end, and also clear from all the farmers who tapped off power from the line; then they short-circuited two of the wires with a jumper about five miles out from the generating station, and ran single-phase current over these two wires. As they did not care to go higher than 3,000 volts, it was necessary to cut out the 2200-13,200-volt transformers at Flandreau. On account of the unequal spacing of the middle wire, they decided to use the two outside wires, with a spacing of 84 inches, for this purpose.

They carried out these tests on Sunday, May 6, 1917, which was the only day of the week when the line could be cut off. Sunday morning the power was shut off the line. A lineman at Elkton pulled out the disconnecting switches at that place and then followed up the line disconnecting all the farmers' transformers between Elkton and Flandreau. At a point which they had previously agreed upon and measured as 5.275 miles from the generating station, the lineman put the jumper across the two outside wires and then the tests were started.

Use was made of a separate bus, a 2300-volt generator, and a 120-volt exciter, placing the instruments

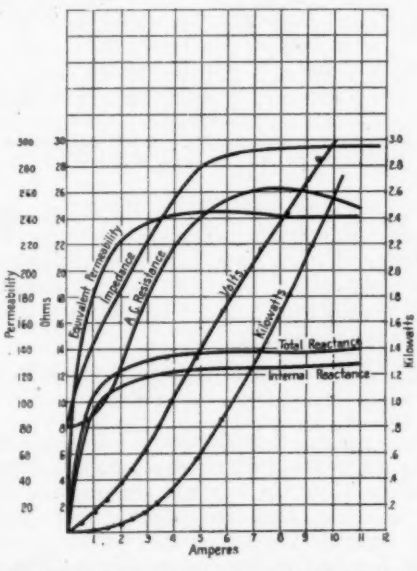


Fig. 6.—Constants Per Mile for No. 6 BWG Galvanized Iron EBB Wire. 100 Cycles. 60-Inch Spacing. 20° C.

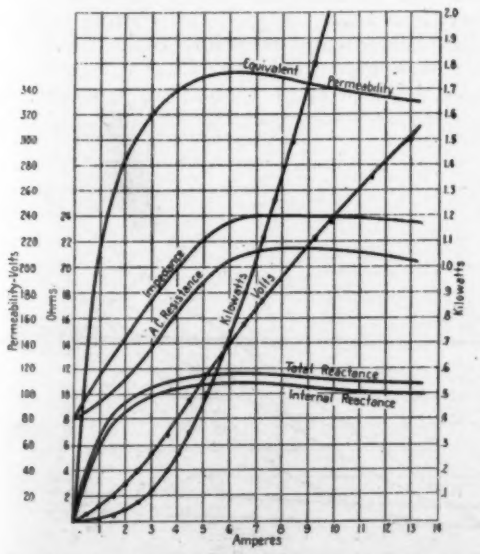


Fig. 5.—Constants Per Mile for No. 6 BWG Galvanized Iron EBB Wire. 60 Cycles. 60-Inch Spacing. 20° C.

between the switchboard and the line. They first sent direct current from the exciter out over the line and measured the direct-current resistance. The resistance of this 5.275 miles of line, or 10.55 miles of wire, checked very closely with resistance taken from standard wire tables.

They next put the alternating-current generator on the line and obtained the range of voltage from 200 to 2800 by changing the field of the generator. In order to get voltages lower than 200, the 115-volt lighting circuit with inserted resistance was put on the line and through the instruments, so that it was possible to get very accurate readings for values of current as low as 0.2 ampere.

As a result of the information obtained, the Dakota Light & Power Company determined that its line was not equal to the load that was about to be put on it. The company decided to raise its transmission voltage and also to restring the line, using a stranded cable made up of three No. 10 B. B. galvanized iron wires.

In the test data the frequency was 61 cycles and the spacing 84 inches. In order to get this information to compare with other tests made by the experi-

menters, they decided to change the figures to correspond to 60 cycles and 60-inch spacing. When the line is transposed the spacing of the wires will be nearly 60 inches. This means a slight change in the internal and

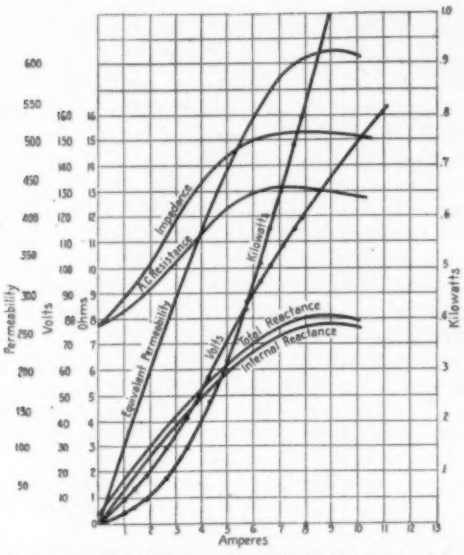


Fig. 7.—Constants Per Mile for No. 6 BWG Galvanized Iron EBB Wire. 25 Cycles. 60-Inch Spacing. 0° C.

external reactance and also a slight change in the impedance and voltage. The constants per mile were then calculated from these corrected readings. Curves of the constants per mile for these corrected conditions are plotted in Fig. 2, the temperature being taken as 20 degrees centigrade.

Effect of Iron and Copper on Line-Voltage Characteristics.

The line-voltage characteristics are considerably affected by the use of iron wires instead of copper. The curves show what the internal reactance is at various current values. The internal reactance of copper is practically zero. The external reactance is practically the same for iron as for copper wires. The inductive reactance of a line using iron or steel wire will be much higher, often 10 times as much as for copper wire. This means a large decrease in voltage along the line if the load is heavy and the power-factor low. On the other hand, if the voltage is high and the line comparatively long there will be considerable charging or capacity current involved which may cause the current to lead the electromotive force on small loads by a sufficiently large angle to cause the voltage to rise at various points out on the line.

Ordinarily in making line-voltage calculations for short high-voltage lines the effect of capacity is neglected, since the regulation obtained by neglecting capacity effects checks within commercial limits with that obtained by accounting for the capacity effect. This method applied to iron wire lines may give results which are entirely wrong.

We will consider briefly how electrostatic capacity affects the voltage regulation. An arrangement of two wires separated by insulating material forms a condenser. The nearer the wires and the longer the line, the greater will be the capacity. In the case of overhead conductors running parallel to each other for several miles, the electrostatic capacity becomes a matter of much importance. The capacity is distributed over the whole length of the line. For short high-voltage lines it is accurate enough for practical solutions to assume one-half the total capacity concentrated at the far end of the line. The following formula may be used for calculating the capacity of overhead lines:

$$C = 0.0388/\log d/R \qquad (1)$$

where

C = capacity in microfarads between one conductor and neutral,

d = spacing between wires in inches, and

R = radius of wire in inches.

The charging current in amperes can be calculated by the formula:

$$I_c = 2\pi f C l E/1{,}000{,}000 \qquad (2)$$

l = length of line in miles,

f = frequency in cycles per second,

E = line to neutral voltage, that is, the line voltage divided by 1.73 on a three-phase line.

A phenomenon often observed on iron wire lines is that the voltage at the receiving end of the line may be higher than the voltage at the generator when the load is so small that the charging current is large compared to the load current.

The diagrams in Fig. 3 show why this is true. In these diagrams, E_o is the generating voltage, E is the receiving voltage, I is the load current, I_o the generator current, and I_c the charging current.

If the load is large and the load current is large compared to the charging current, the effect of capacity may be to make the generator current smaller than the load current and therefore make the I^2R losses smaller than they would be if the line were without capacity. The voltage regulation, however, will be

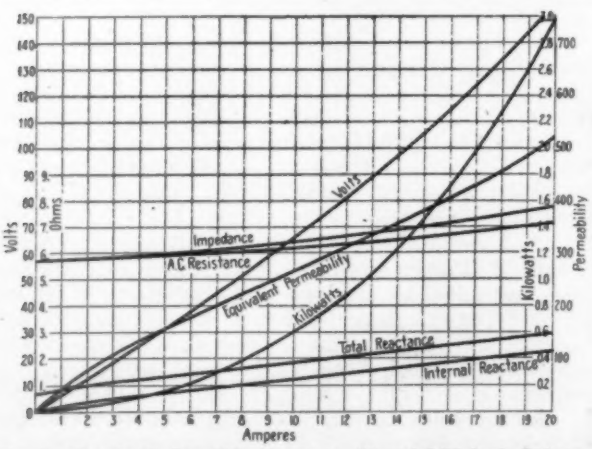


Fig. 8.—Constants Per Mile for Seven-Strand 5/16-Inch Galvanized Steel Cable. 60 Cycles. 36-Inch Spacing. 12° C.

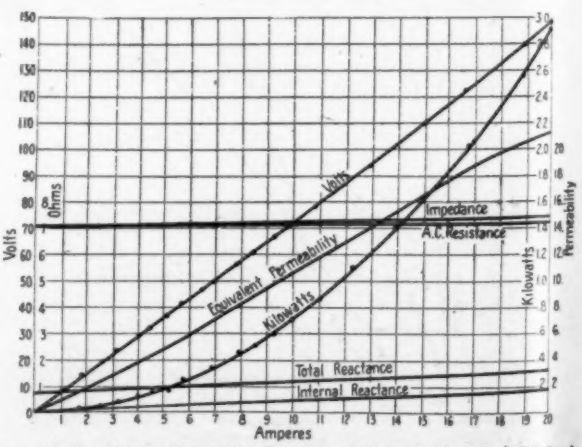


Fig. 9.—Constants Per Mile for Seven-Strand No. 12 5/16-Inch Siemens-Martin Steel Cable. 60 Cycles. 60-Inch Spacing. 20° C.

bad because the reactive drop will have a greater effect, especially if the power-factor is low.

The diagram in Fig. 4 shows the effect of capacity on a heavily loaded line with a power-factor less than unity. The difference between the generator voltage and the receiver voltage may be much greater than it would be on a copper-wire line having the same resistance because I_oX, the reactive drop, is much greater for iron wire. On the other hand, this same I_oX raises the voltage on off-peak loads.

The inductance per mile of line is given by the following formula:

$$L = 0.0805\, y + 0.741 \log d/R \qquad (3)$$

L = inductance in millihenrys per mile,
d = distance between wires in inches,
R = radius of wire in inches.
y = permeability of the material used as a conductor.

Kinds of Iron Wire to Select From.

In selecting iron wire for transmission purposes a wide variety is available to choose from. The wire selected should have low resistance, low first cost, and low internal reactance. What is known as E. B. B. solid wire has low resistance for small currents, but the resistance and internal reactance rises very rapidly as the current increases, and soon becomes higher than for B. B. or even ordinary steel wire. For example, with a 60-cycle current of 8 amperes the resistance of a No. 6 E. B. B. solid iron wire is 20 ohms or 2.5 times as much as the direct-current resistance of the same wire. This means large I^2R losses and a large reactive drop. The resistance of an E. B. B. wire made up of three strands of No. 10 B. W. G. galvanized iron wire, and with 8 amperes of 60-cycle current is 9.6 ohms, whereas the direct-current resistance is only 6 ohms.

A conductor made up of three strands of No. 10 B. W. G. galvanized iron B. B. wire has a direct-current resistance of 7 ohms per mile, and this at 8 amperes of 60-cycle current rises to 9.1 ohms as compared to 9.6 for the E. B. B. This is an increase of only 30 per cent. A wire made up of seven strands of No. 12 B. W. G. E. B. B. wires has a direct-current resistance of 4.3 ohms and with 8 amperes 60-cycle current the resistance is 5 ohms, or an increase of only 16 per cent.

The alternating-current resistance of the E. B. B. wire rises so rapidly with the current that it soon becomes greater than that of even the steel wire. The cost of a B. B. wire having the same direct-current

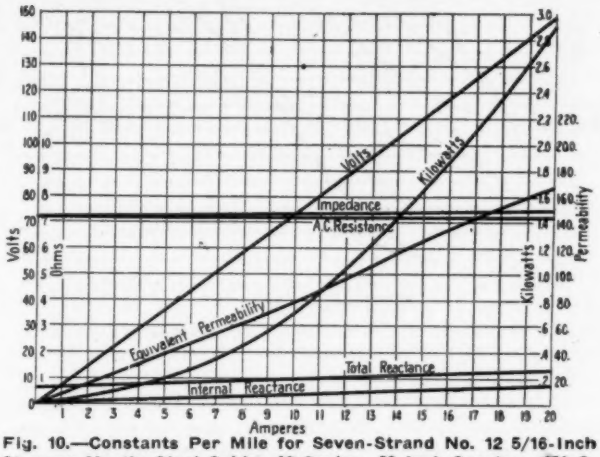


Fig. 10.—Constants Per Mile for Seven-Strand No. 12 5/16-Inch Siemens-Martin Steel Cable. 60 Cycles. 30-Inch Spacing. 13° C.

resistance as an E. B. B. wire is almost exactly the same, whereas the cost of B. B. wire as compared to steel having the same direct-current resistance favors the B. B. If very much alternating current is to be carried, B. B. or steel wire is much better than E. B. B. There is very little choice between B. B. and steel, since on off-peak loads B. B. is slightly better. Solid iron wire should never be used except on small extensions and where the current will never exceed two amperes. A three-strand or a seven-strand wire should be used for higher current values.

For example, suppose we take a line 10 miles long with a 50-kilowatt load over a three-phase, 60-cycle, 11,000-volt line. A seven-stranded conductor made up of ordinary steel wire and having an area of 25,000 circular mils would be suitable. The resistance per mile at full load is 18 ohms, the voltage drop about 9 per cent and the weight of the conductor 10,400 pounds. The cost at 7½ cents per pound would be $780. If copper conductors were used No. 6 wire would be used since smaller wires would be too weak mechanically. The weight of the conductors would

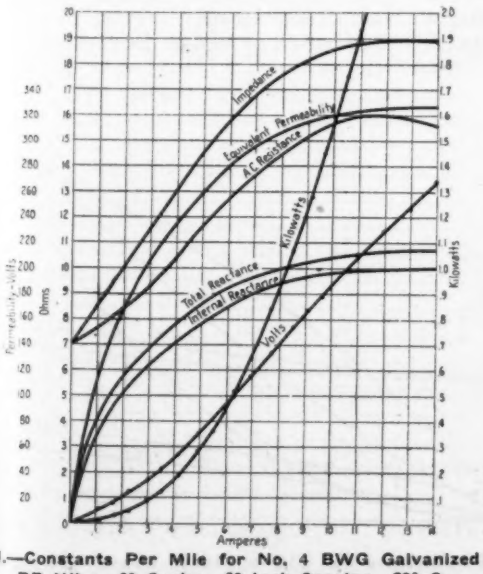


Fig. 11.—Constants Per Mile for No. 4 BWG Galvanized Iron BB Wire. 60 Cycles. 60-Inch Spacing. 20° C.

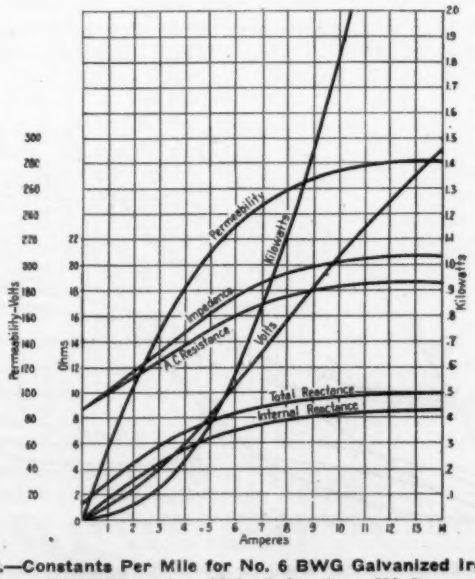


Fig. 12.—Constants Per Mile for No. 6 BWG Galvanized Iron BB Wire. 60 Cycles. 30-Inch Spacing. 20° C.

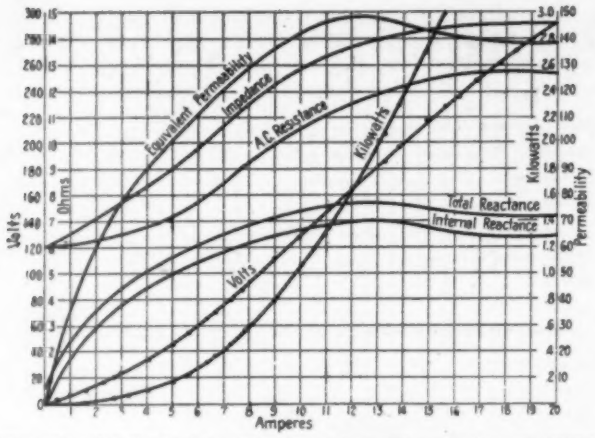


Fig. 13.—Constants Per Mile for Three Strands No. 10 BWG Galvanized Iron EBB Wire. 60 Cycles. 60-Inch Spacing. 20° C.

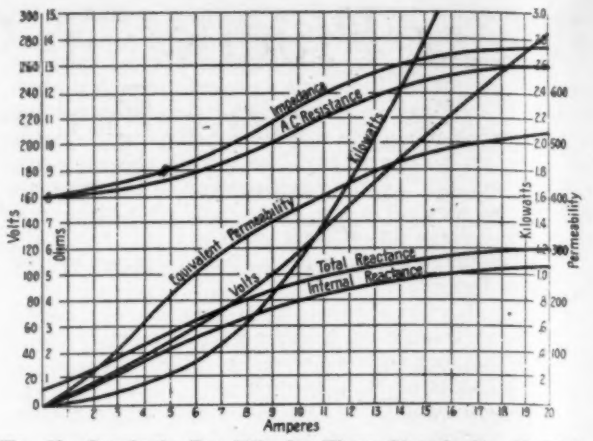


Fig. 14.—Constants Per Mile for Three Strands No. 10 BWG Galvanized Iron BB Wire. 60 Cycles. 25-Inch Spacing. 20° C.

be 12,570 pounds and the cost at 40 cents a pound, $5028, as compared to $780 for iron wires. If the voltage regulation is to be 9 per cent, 500 kilowatts could be carried on the No. 6 copper wire line. Steel or iron wires for 500 kilowatts and 9 per cent regulation would cost nearly twice as much as the copper wires and would call for heavier poles, crossarms, etc.

Iron Wire Worth Considering Even in Normal Times.

The ratio between the price of copper and iron is about the same in times of high prices as when prices are low, therefore the reasons advanced for using iron wire in special instances are not a direct result of war prices. Iron conductors were used quite extensively in Germany long before the war began, and are being introduced in America now largely because central stations are forced to be more economical and because they cannot make both ends meet if they put up a transmission line that will carry 500 kilowatts economically when there is only 100 kilowatts in sight for several years.

If it costs, say, three-fourths cent per kilowatt-hour to put energy on the switchboard, and with a load-factor of, say, 20 per cent, a 30-mile, three-phase, iron wire line at 23,000 volts will show a saving for loads of about 200 kilowatts or less. For larger loads copper wire will be more economical. With a line current of one ampere there is a very large saving effected by using iron wire. With two amperes the saving is a little smaller, etc., until with about five amperes in the line there is no choice between copper and iron. For large current values copper costs less. Each case will have to be solved on its own merits, but in general it is safe to say that iron wires are worth careful consideration on short high-voltage lines where the current is less than five amperes.

It is interesting to study the effect of kind and size of wire, spacing, frequency and temperature upon the characteristics of iron conductors. For this purpose there are reproduced in Figs. 5 to 16 curves of the constants per mile of different iron wires under different conditions. These were given in the theses referred to. Figs. 5, 6, 7, 9, 11, 13, 15 and 16 were given in the report by Abbott and Butterworth, while Figs. 8, 10, 12 and 14 were reported by Oakes and Eckley. These curves show very effectively the wide variation caused by change of any of these conditions and emphasize the importance of considering every detail before deciding on use of iron wires for transmission purposes. In spite of this, as already pointed out in the foregoing, iron wires deserve careful consideration where energy is to be distributed in relatively small amounts over comparatively short lines, such as would serve farmers or other rural customers.

Public Service Company Increases Wages.—The Public Service Railway Company, Newark, N. J., has increased the wages of employees from 25 to 28 cents an hour, with maximum raised from 32 to 34 cents an hour. The new schedule will be formally placed in operation on October 1.

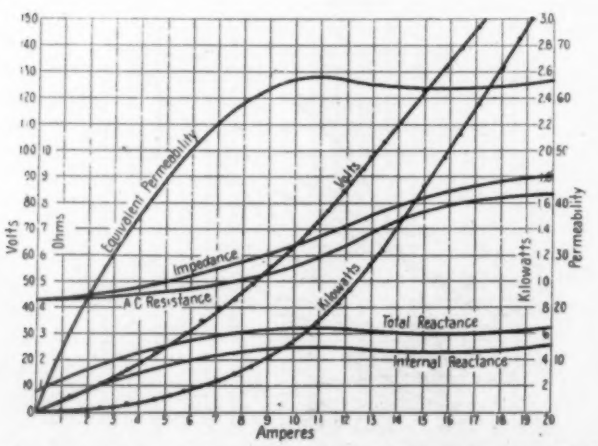


Fig. 15.—Constants Per Mile for Seven Strands No. 12 BWG Galvanized Iron EBB Wire. 60 Cycles. 60-Inch Spacing. 20° C.

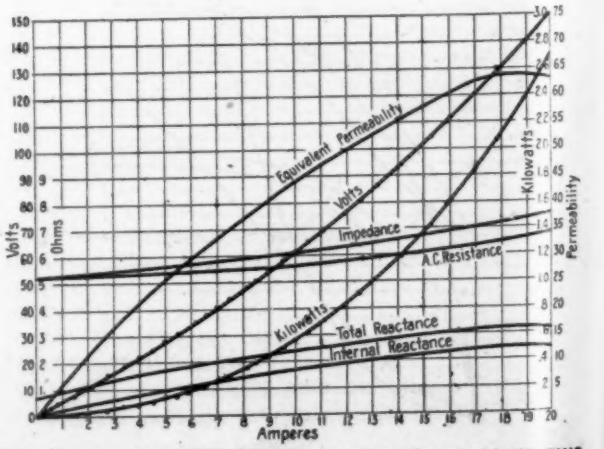


Fig. 16.—Constants Per Mile for Seven Strands No. 12 BWG Galvanized Iron BB Wire. 60 Cycles. 60-Inch Spacing. 20° C.

Better Practice in Operation of Stokers and Boilers Needed

Greater Fuel Economy Can be Obtained by the Establishment of Improved Methods of Operation—Problem is One for Central-Station Managers

By JOSEPH G. WORKER

AUTHORITIES have asserted that out of the production of 600,000,000 tons of coal in the United States in 1916, twenty-five per cent was wasted, amounting to $500,000,000 a year. It is quite surprising to find that the coal-consuming public does not dispute the statement.

It is, therefore, evident that there is an immediate task before us, and those whose daily duties take them into this problem should co-operate to the fullest extent in eliminating this waste and obtaining the end desired.

Conservation of fuel, at this time, becomes very necessary. There is no question but that difficulties will be encountered in transportation, labor, etc., in the production of coal, and this is all the more reason why a strong movement should be inaugurated to stop the waste in its utilization.

There are many ways to attack this problem, but one plan stands out above all others—and that is the establishment of a better practice in the operation of fuel-burning equipment.

What is needed is a strong movement towards bettering conditions and building up a higher standard of intelligence in boiler-room operation. It requires men of intelligence and good judgment to supervise fuel economy, and the end desired will never be attained as long as we hold the old idea that the requisites of good firing are brawn and a strong back.

This movement, without question, would have the support of all engineers who are daily active in this work, but what is required is the support of the executives, some of whom (and perhaps unconsciously) set the standard of intelligence in the boiler room, and, in a number of cases, this is done without full knowledge and facts of the economic necessity of boiler-room operators.

Mechanical stoker equipment is not, and never can be, a substitute for intelligence and good judgment, and there are just as good reasons for intelligence in handling stoker-fired plants as in hand-fired plants.

Just at this time, although it might sound radical, it would not be far away from good economical judgment to recommend the placing of technically-trained men in every reasonably sized boiler room in this country, charging them with the responsibility of eliminating the waste of fuel. It is not at all advocated that men be replaced, but rather the building up of men to a higher degree of intelligence in the problem of fuel combustion.

If all those interested would support a movement of this kind, it would be a speedy solution of one of the big fuel wastes in boiler plants.

Engineering Progress in Fuel Combustion.

There is no question but that engineering progress has been made in the past few years, along certain defined lines, in the method of utilizing fuel, but when they tell us that hundreds of millions of tons of coal are being wasted every year, this surely is a strong motive for impelling this question of fuel economy.

The Government has published a vast amount of information through the Bureau of Mines, Department of the Interior, regarding the utilization of fuels. It has also investigated and made known more efficient methods to be used. If those data were applied to specific cases, there is no question but what a lot of good would be done, and better economy obtained in the average plant.

Large central stations are going through elaborate processes to determine the most economic way to burn fuel and the best methods for economic operation. On account of the typical power-station load, and the desirability of carrying peaks by merely raising the steaming capacity of boilers in service, old equipment is being replaced, in many cases, by more modern equipment.

A few years ago, a large plant in Chicago was using seven and a half pounds of coal per kilowatt-hour, and, at present, it is using two and seven-tenths pounds of coal per kilowatt-hour, with the same kind of fuel. In fourteen years this engineering progress in turbine, boiler and stoker equipment and methods of operation, has been equivalent to a saving, in one year, of approximately two and one-half million tons, or 58,000 carloads, of coal.

Work of Combustion Engineers.

In the past few years, a number of engineers have specialized in combustion of fuels and boiler-room operations, but it seems that there has not been very much enthusiasm aroused, on the plant owner's part, in obtaining this expert advice. It is not unusual to find combustion engineers reporting large savings of fuel and labor, which the plant owners accept with interest, but they do not proceed to execute and put in operation any of the recommendations. It is pretty well agreed that it is good practice to obtain engineering advice in the co-relation of equipment, but it has not become very popular to obtain engineering advice on operation of the boiler room.

Equipment.

There have been few changes in the mechanical design of the overfeed and chain-grate types of stoker for burning the high-carbon coals found in the east, and high-ash coals in the middle west. Better standards of settings have come into force which have assisted greatly in increasing the economy and overcoming operating and smoke difficulties.

From a general survey of power plants, it would seem that the present method of operation is around 150 per cent of boiler rating. At this steaming capacity, the fires are handled very easily, and there

is no trouble with clinkers, smoke, brickwork or maintenance. The very best economy is also obtained at this steaming rate. The present-day requirements are to maintain this economy at normal steaming capacities, but to also provide a reserve capacity in the same equipment so that sudden demands for steam can be met. The need is for flexibility of equipment to meet any kind of emergency. If it is necessary to take a boiler off the line, it is expected that the equipment already in service and under fire will take up the load and handle it with sustained reliability.

Boiler-room economies have demanded that this reserve capacity be placed in the coal-burning equipment and not in idle boilers.

Operating Methods.

Although we often hear that the savings in power-plant operation are to be made in the boiler room, it is very seldom that a distinction is made between the possibilities due to equipment, and those due to the method of operation.

The necessary losses in connection with the generation of steam using coal as a fuel, are from eight to ten per cent of the total heat value. The highest theoretical efficiency, therefore, is between ninety and ninety-two per cent. Combined boiler and grate efficiencies of from seventy-five to eighty per cent are quite common test results. In other words, from eighty-two to eighty-nine per cent of all the heat theoretically available is actually utilized which shows how closely modern steam generating apparatus approaches the theoretical maximum.

When the statement is made, therefore, that the savings in a power station must be made in the boiler room, this refers to operation and management and not to the design of the equipment used.

There is not much difference in the equipment used for burning fuel throughout the United States, but there is a wide difference in the operating methods. Many engineers having experience with plants where it is necessary to obtain highly efficient results in producing electrical energy, obtain the wrong operating viewpoint of industrial and the moderate-size boiler plant, where the boiler plant is merely a side adjunct to their general business.

The waste of fuel is more pronounced in these small plants, and it is not uncommon to find that it is very difficult to enthuse the small-plant owner in things that effect economy in the boiler room either in equipment or operating methods.

A large saving in fuel can be made by giving more attention to the methods of operation. This not only includes applying the equipment in order to facilitate easy handling, but also requires that particular attention be given to the character of labor used.

In dealing with economic terms, we often hear of 70 per cent combined boiler and grate efficiency being obtained, it being implied that this is a good average economy. A review of plants throughout the United States would probably show that the operating economy is more like 50 per cent. These same plants, however, could increase their economy if proper attention were given to the operation.

Boiler-room Operators.

Conditions in boiler plants show that the operators must be trained in the combustion of fuel. The operation of boilers and stokers must be approached along more scientific lines. It is only necessary to examine the conditions of the plants in this country where coal is fired in order to realize what is needed and how much it is needed.

Specialization is as much needed for the highest efficiency in coal burning as in any other work. A higher measure of skill is required in the boiler room in order to maintain the balance between the economic possibilities due to operation and those due to equipment.

Suitable instruments should be used for furnace operation but with their installation should go training in their use. Too many instruments are now installed and inoperative, because the men in the boiler room have shown no real grasp of the subject of fuel combustion, nor do they know how to use the information indicated by them.

This plan of building up a standard of intelligence in the boiler room involves no disparagement of this kind of work. The point is that opportunities should be offered in this work the same as in any other line of endeavor. A combustion operator placed in a boiler plant, and having charge of the efficiency of a number of fires without being encumbered with other labors, will soon show his worth and the result of his skill. We must differentiate between work involving draft, furnace conditions, air requirements, etc., and work involving the shoveling of coal, oiling and caring for operating mechanism, pulling clinkers and ash handling, if we would effect the greatest gain possible in fuel burning.

There are economic reasons for developing a system in our boiler plants that would successfully involve men for both kinds of work. If we are to acquire and maintain a high standard of fuel burning, then those who are actually engaged in the process must have every facility at hand for an intelligent understanding of the principles involved.

There is a strong reaction coming in the general methods of operation in boiler plants. The feeling is growing that a change is necessary. Nothing can be accomplished, however, without the co-operation of all and a full appreciation of the educational uplift necessary.

American Association of Engineers Organizes Three New Chapters.

The Board of Directors of the American Association of Engineers has granted charters to the members in St. Paul, Indianapolis and Milwaukee, for formation of local chapters in these cities. This makes a total of seven chapters which have been organized since the Association was incorporated about two years ago. The total enrollment of the national organization is now over 2,200 members.

A joint meeting of the Association and the Detroit Engineering Society was held in Detroit, Mich., on August 30. It was the unanimous opinion of the engineers present that the Detroit Society should form a working co-operation with the American Association, as it has been carrying out a similar program locally for Detroit as the other organization has operated in a broader way. The Detroit Society has a total enrollment of about 700 members and if this working co-operation is established it will mean the furthering of the work laid out by the Committee on Engineering Co-operation.

Membership in the American Association of Engineers is being extended to all technical engineers in military service without payment of initiation fee or dues. This is part of the co-operative plan to keep them advised as to progress in the engineering field and to give them personal assistance upon their return to professional work.

AMMONIA AND NITRATE PLANTS TO BE BUILT BY GOVERNMENT.

Process of Nitrogen Products Company to Be Used in United States.

Congress appropriated $20,000,000 to be used in supplying nitrate for munitions and fertilizers; and it is proposed to spend $3,000,000 of this sum to build a synthetic ammonia plant to employ the process of the General Chemical Company. The plant is to be located in Virginia, and is to have capacity for producing 60,000 pounds of ammonia per day. The sum of $600,000 will be used in building a plant for the oxidation of ammonia to nitric acid to the amount of 24,000 per day. The Government has accepted the offer of the Nitrogen Products Company to allow the use of its Bucher process in this country for the production of sodium cyanide and ammonia, and $200,000 has been allotted for experimenting with and developing this process in an industrial way. The sum of $100,000 is made available for investigation of processes for producing nitrogen compounds required in the manufacture of explosives and fertilizers.

Hydroelectric Investigation at Niagara Falls.

Three commissioners have been appointed by the Attorney-General of Ontario under the public inquiries act to report on the use of water from the Niagara River by the Electrical Development Company and the Canadian Niagara Power Company. The commissioners are Chief Justice Sir William R. Meredith, Justice R. F. Sutherland, and Justice T. Kelly.

The report will cover the quantity of water in cubic feet per second which the Electrical Development Company is entitled to divert or use, the amount of power in horsepower which the company is entitled to generate, the extent, if any, by which the capacity of the works installed or equipped by the company may be developed, and the price and terms and conditions upon which the power to the extent of such excess should be delivered to the Hydro-Electric Power Commission of Ontario.

The appointments follow the statement that engineers for the Hydro-Electric Commission and the Ontario Government have reported an alleged illegal diversion of water from the Niagara River at Niagara Falls, Ont., by the Electrical Development Company and the Canadian Niagara Power Company.

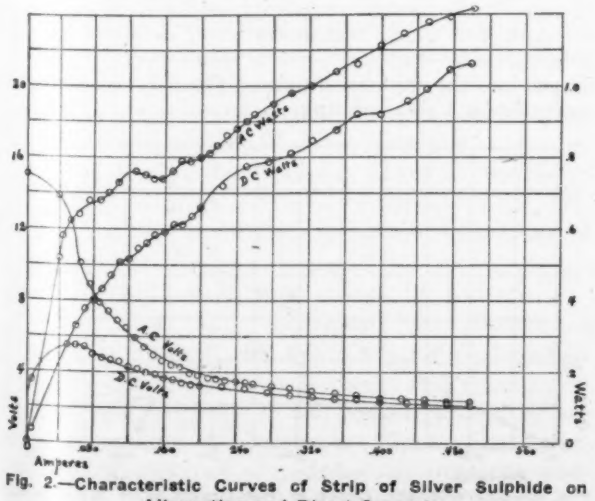


Fig. 2.—Characteristic Curves of Strip of Silver Sulphide on Alternating and Direct Current.

SOME ELECTRICAL PROPERTIES OF SILVER SULPHIDE.

An Advance Report on an Investigation Conducted by the Government Bureau of Standards.

By George W. Vinal.

Native silver sulphide is seldom pure, but the sulphide may be prepared chemically in the form of

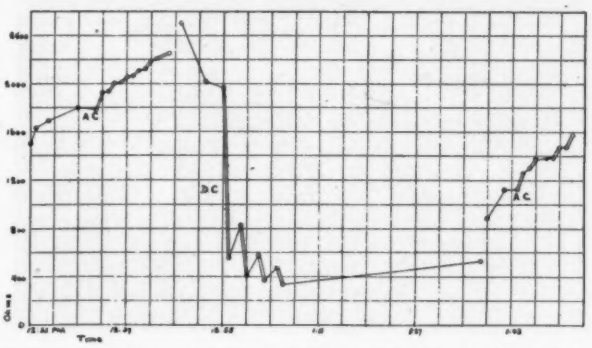


Fig. 1.—Resistance of a Strip of Silver Sulphide as Affected by Small Direct and 60-Cycle Alternating Currents. Current Was Applied During Last 10 Seconds of the Intervals Shown by Double Lines.

a black powder which has a melting point of about 825 degrees, centigrade. It was found that the sulphide so melted could be rolled into thin strips or drawn into short wires like a metal. At a temperature of about 200 degrees it becomes very malleable and may be hammered out on a hot plate or drawn through a heated draw plate. Working the sulphide at this temperature changes its electrical properties. In the form of a strip which has been rolled cold this substance is both a metallic and an electrolytic conductor at the same time. When drawn hot it acts like a metallic conductor with nearly zero temperature coefficient.

In making experiments with the sulphide it was necessary to find some means of making good electrical contact between it and copper lead wires. It was not found possible to solder to the sulphide directly and brass clamps are not desirable, but it was found possible to silver plate the ends of a piece in a silver-potassium cyanide solution. After this is done a copper wire can be soldered on.

When the sulphide is rolled at room temperature it has a large negative temperature coefficient of resistance similar to an electrolyte. When worked at 200 degrees, centigrade, the temperature coefficient is approximately zero. It is not easy to explain why the mechanical working makes so great a difference in the electrical properties, but it seems likely that rolling at room temperature may produce minute cracks, whereas wire which is drawn hot is probably homogeneous.

The material rolled at room temperature was found to have different resistance when tested with direct and alternating current. Fig. 1 shows some of the results. When alternating current is applied the resistance increases; when direct current is applied the resistance decreases, but shows a tendency to recover upon standing. The double lines in the figure indicate the periods during which current was applied. No such effects were observed when similar experiments were tried with the wire which was hot drawn, but the same resistance was found for both direct and alternating current.

Fig. 3.—Outcropping of Silver in Middle Due to Electric Current Which Flowed Parallel to the Lines of Silver.

Fig. 4.—Anode End Showing Where the Terminal Burned Off. Magnified 50 Diameters.

Fig. 2 shows the volt-ampere characteristic curve for a strip 0.4 cm. wide and 0.007 cm. thick. The hot-drawn wire in contrast to this gave a straight line through the origin.

The specific resistance at 25 degrees, centigrade, was found to be 17,300 microhm-centimeters or about 10,000 times the resistivity of copper.

As resistance measurements indicated electrolytic conduction of the cold-rolled strips, experiments were made to discover any electrochemical decomposition. Direct current was applied to a strip having copper leads soldered to its silver-plated ends. An initial current of 25 milliamperes gave no visible effect. The current was increased at intervals until with 200 milliamperes a discoloration of the plate at the anode end was noticed. A still larger current appeared to destroy the silver plating and finally burned off the terminal, but before this happened a myriad of little shiny silver crystals appeared on the black surface of the sulphide as shown in Fig. 3. The appearance of these crystals was studied under the microscope and it was found that they occurred to within a small fraction of a millimeter of the anode terminal as shown in Fig. 4. The appearance of some of these crystals suggested that they had been expelled from the interior of the strip with considerable force. The strip appeared to be made up of a multitude of tiny electrolytic cells between which metallic conduction occurred. The cross-section of this strip was 0.3 by 0.01 cm.

Extent of Electrical Service at Army Cantonment.

In an official statement issued by Col. I. W. Littell, in charge of cantonment construction, credit is given the electrical industry for the completion of all installations in the specified time, although in several instances extensive transmission lines had to be constructed.

Col. Littell, in the official statement, says, "Every national army cantonment has required the building and installation of a transmission line for electrical current. At Camp Upton it has been necessary to take electrical power from Northport, on the north shore of Long Island, a distance of nearly 30 miles. In addition to this, the transmission line has been strengthened all the way back to Brooklyn in order that proper service can be given; in order to furnish the necessary railroad facilities, the Long Island Railroad has been required to take up rails from sidings to build the spur-tracks required at the cantonment.

"To bring the construction materials to Camp Meade, which is some distance from an electric railroad and not on any steam railroad, it was necessary to rebuild the electric railroad to make it of sufficient strength for steam transportation. In addition, the Pennsylvania Railroad built a spur several miles in length into the cantonment site. The Government had to condemn a right-of-way.

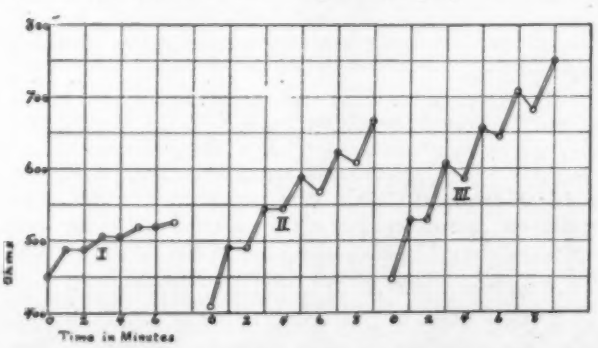


Fig. 5.—Resistance of a Strip of Silver Sulphide With 60-Cycle Alternating Current.

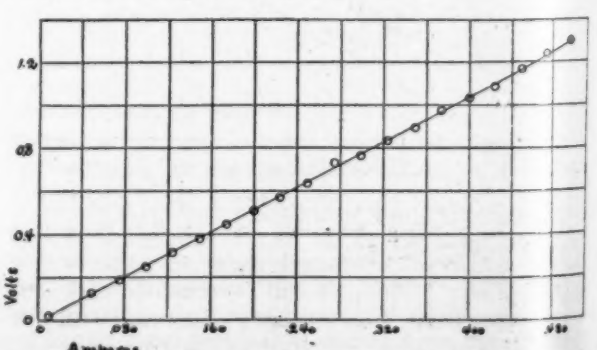


Fig. 6.—Characteristic Curve of Hot-Drawn Wire With Direct Current.

Editorial Comment

Disseminating Useful Ideas on Operating Practice

THIS is a critical period for most branches of the electrical industry. When the world war was brought to our shores we realized that our becoming involved in it would bring serious problems to nearly all industries. The electrical industry was one of the first to prepare itself to meet them and much indeed has been done by various electrical interests to meet extraordinary demands for electrical products and service at the very time when there is unusual scarcity of materials and men. The nation urgently needs electric power and communication service, electrical machinery and appliances to a greater extent than ever, because these make for efficiency wherever employed, and the cry of the hour throughout the country is for efficiency. Electrical manufacturing and telephone, telegraph and central-station service are the branches of the industry that have been most affected and they have made progress in adopting measures of the highest efficiency through which the emergency is being overcome.

However, with the calling to the colors of the National Guard and of the first troops of the new National Army the seriousness of the situation has been brought home to electrical interests more keenly than at any other time since war broke out. Evidently electrical men are now fully recognizing how important a part they are called upon to play and are striving stenuously to put their houses in order for still greater demands. This is a task of no small proportions and one which calls for hearty co-operation by all electrical men.

One of the most urgent problems just now is to enable central-station operating departments to supply additional loads with such equipment as is now available or can be easily remodeled or replaced to advantage. At the same time there must be met uncertainties of fuel supply and diminished labor supply. Heroic measures must therefore be taken and it becomes the duty of every electrical man to aid in disseminating what knowledge he has of value in this matter. There is special need by the operating departments of the smaller central stations for all the helpful suggestions possible to enable them to meet the situation.

To further this movement the ELECTRICAL REVIEW is starting with this issue a department of operating practice which will appear as a regular feature of each number. It will contain articles by experts on methods for increasing efficiencies and outputs and is also open to contributions from our readers on any features that have been found valuable in actual practice. Electrical men often are not as well versed on the best methods in steam and other mechanical features of operating practice, whereas mechanical men are commonly deficient on electrical matters. On these and other related topics the country needs the widest possible dissemination of knowledge that will promote prompt, efficient and reliable power service. This is not a time when such information is to be kept under one's hat. The ELECTRICAL REVIEW therefore hopes that this new department will act as a general forum for the good of electrical operating men who are in need of every assistance that can be afforded them and also for the good of the industry and country as a whole.

Help for Communities that Help Themselves

IN AN editorial article printed in *Collier's Weekly* which assumes to give some of the reasons why Portland, Ore., has not reaped the full advantage of its favorable position on the Pacific Coast, comments such as the following appear:

"The long-delayed railroad extensions into central Oregon, *the slow, hard fight made to get good roads throughout the Willamette Valley, the dependence of trolley and interurban development on eastern men and eastern capital,* the failure to get modern park and street planning for Oregon cities, an ancient disinclination to support and enlarge the State University as the keystone of an adequate Oregon educational system—all these and more make up the record. Those who know can say whether that record is an indictment. Tea in the rose-misted arbors of King's Heights, bridge parties in its Louis Seize reception halls, and golf on the velvet lawns out at Waverley will not do so very much to establish Portland as the civic queen of the Northwest."

Reference to the lack of local support for local utilities is particularly pertinent at this time. The trite but tried saying that God helps those who help themselves, applies equally well to the aid given by financial interests to communities. If they show the proper disposition to invest in properties supplying their own needs, further support will not be lacking.

Eminent Domain and War Service

THE power of a public utility to take land for the extension of its service under approval of proper authority is valuable in times of peace as a preventive of obstruction by property owners who are unwilling to share in a development of general benefit; but under war conditions the right of

eminent domain becomes literally indispensable in a case like one recently reported by the Gas and Electric Light Commission of Massachusetts. It seems that the New England Power Company applied to the Commission for authority to construct a high-tension line some 7 miles long between the existing lines at Leominster and the Federal army encampment at Ayer. At Ayer about 40,000 troops are to be quartered this fall and the electrical supply of the cantonment, according to the decision, will require the delivery of about 2000 horsepower from the transmission system. Rights of way were secured for nearly the entire route, but in a few cases the land-owners stood out against the program, despite its importance to the military interests of the country.

Under the terms of legislation passed but a few years ago, the Commission sat as a court of appeal upon the petition, quickly found that public convenience and necessity require the construction of the line, and authorized the company to take the necessary land to complete its installation. The case shows the benefits of being able to determine the issue of a civil matter of military importance by the regular machinery of commission regulation, instead of being obliged to invoke special military or legislative sanction. It shows that the scheme of commission regulation designed for peace conditions is flexible enough to be of real service in time of war.

Rear Attacks Must Not be Tolerated

BOTH Atlantic and Pacific Coast shipyards have been the scenes of strikes of workmen which threatened to become a national calamity. Various sections of the West have been suffering from the activities of irresponsible labor agitators. Alarming movements have been started among machinists and other workers engaged in turning out supplies vitally needed by the Federal Government. It is known that some recent agitations were carried on by aliens. It behooves Congress to put an end to the vicious plots of enemies of the nation and to guard against all crippling strikes. There would be no injustice in requiring labor to refrain from any futher controversies so long as the war lasts, accepting mediation and arbitration to prevent cessation of production.

A great strike among American plants, including those of the electrical industries might be as disastrous to the national cause as a great reverse in battle. Such a calamity would almost inevitably lengthen the war and thus cause useless slaughter of American soldiers.

The secret agents of our enemies are bold and numerous and resourceful. They will not, however, perform effective work among the nation's drilled and disciplined fighting men. They will labor—they are now laboring—among the multitudes who, given immunity from army service, must provide strength for the nation in its electrical plants, mines, mills and factories, in its camps and shipyards and on its great transportation lines. The public will not do its whole duty unless it requires Congress to pass a law establishing for the period of the war complete immunity to the nation from labor disputes, at least in all lines of transportation and in all forms of production affecting national efficiency.

Standing by the Government

MEN of the electrical industries have done as much or more than any other class to aid in vigorous preparations for the present war. They will therefore find in the declaration made this week at Atlantic City, that *American business has no intention of profiting at the expense of the government,* a true expression of their sentiments. Speaking before the Chamber of Commerce of the United States, which has been holding its sessions there, President R. G. Rhett pointed out that, while there have been cases where selfishness and greed outweighed patriotism, these have been exceptional. The great body of men in the electrical and other industries have invariably stood squarely behind the government in all of its plans. That they will continue to do so was the conclusion unanimously reached.

A note of cheer and encouragement was also brought out by Franklin K. Lane, Secretary of the Interior, who stated that while Americans are concededly able to make money, we shall prove that we also know how to make war—whole-hearted, resolute war; war that means organization, machinery, science; war that means men by the millions and money by the billions; war that means a certain self respect and a world that men can grow in. Speaking of our legislative bodies, he affirmed that no other parliament in so short a time ever passed so great a volume of well-considered legislation as has our present Congress in the last five months. We have loaned large sums to our allies, have raised an army of a million and a quarter, inaugurated a new industry—that of making aeroplanes, revived a dead industry—that of building ships, placed powers over exports and prices, over industries and resources, in the hands of the President that will give him the weapons he needs, made laws to punish domestic enemies, and courageously placed the burden of defense upon those who can best bear it. This is a record that no nation has excelled. It is a record that shows unflinching purpose.

In numerous special articles and summaries on mobilization, on shipbuilding, on supplying power and lighting to cantonments and industrial plants engaged in government work, or auxiliary to it, and on various other features of service which can be rendered by the classes of men who form its readers, the ELECTRICAL REVIEW has pointed the way to greater opportunities. That these will be realized to the fullest possible extent is its confident expectation. Meanwhile, gatherings of business men such as that held this week at Atlantic City for the purpose of developing further means of aiding President Wilson and the Government of the United States in prosecuting the war to a successful issue, cannot fail to be of great service both to the nation and its allies.

HAPPENINGS IN THE INDUSTRY

Details of Convention of Jovian Order—International Association of Municipal Electricians Meets—Report of Northwest Electric Light and Power Convention—News Notes

DETAILS OF JOVIAN CONVENTION

Annual Convention to Be Held in New York October 22 and 23.

As noted on page 480 of our issue of September 15, the annual convention of the Jovian Order will be held in New York City, October 22 and 23. Headquarters will be at the McAlpin Hotel, where all sessions will be held.

The following facts concerning the meeting have been announced by the central office at St. Louis, at the request of Jupiter Henry L. Doherty:

We are a unit in our belief that the Jovian convention should truthfully reflect that patriotic spirit of our great order and industry, which inspires us to devote our time and energies to serious-minded welding of all our resources into an instrument of constructive power, for the assistance of our country in its hour of need.

It is, therefore, only right and proper, and has been so determined, that this gathering of representative men shall labor intensively to conclude the necessary business of the meeting in the shortest possible time, uninterrupted by the elaborate entertainment that has marked the previous annual Jovian assemblies.

The convention will, as of old, and as no other convention does, furnish a common ground upon which shall gather all branches in the electrical field for the charting of co-operative effort to advance those endeavors which affect the industry as a whole.

At no other period in the history of electrical development has it been as necessary as it is today that each branch of the industry recognize in a practical manner its inter-dependence with relation to all other branches, and the necessity for co-ordinated effort.

In appreciation of the wonderful vehicle afforded by the Jovian Order to develop to the maximum degree this spirit of intercommunion between all divisions of the industry a specific, thoroughly workable plan will be presented for the consideration of the convention, whereby Jovianism may be immediately employed for this helpful purpose.

Importance of Meeting.

This convention is of utmost importance. There will be presented for its acceptance or rejection extremely vital changes in the existing method of operation of the Jovian Order.

It is the belief of not an inconsiderable number of Jovians that upon the passage of some or all of the proposed amendments depends the future upward progress of the Order. Let all members see to it that they earn the right to pass upon the work of others by not neglecting their own duty in helping frame the Order's laws of procedure. This can only be done by attendance at the annual meeting, it can not be done by criticism after the meeting.

It is needful to place especial emphasis upon this fact—no amendments can be acted upon unless not less than 200 Jovians in good standing are present at the meeting at which the amendment is voted. That number is specified by the Jovian constitution as the required quorum.

To secure this quorum it is imperative that every Jovian who can possibly attend, even at some personal sacrifice, must do so. There will be much in the convention itself that will make the effort worth while, and there are few who can not find within New York City many ways in which to employ profitably a few extra hours afforded by the trip.

The program will include addresses by capable speakers of national and international fame on subjects bearing upon the newer problems of our industry induced by the European conflict. Throughout the business of the meeting and in a number of specific ways a note of patriotism will mark the loyalty of our splendid body. The convention will close on Tuesday evening with a simple dinner where the fine old spirit of Jovianism will give welcome to the newly elected officers of the Order.

INTERNATIONAL MUNICIPAL ELECTRICIANS IN ANNUAL CONVENTION.

Adopts Resolution Disapproving Concentric Wiring—Many Technical Papers Read.

International Association of Municipal Electricians met in annual convention at Niagara Falls, N. Y., September 11 to 14, in the auditorium of the Cataract House. The convention was called to order by W. H. Flandreau, Mount Vernon, N. Y., in the absence of the president of the association, Robert J. Gaskill, Fort Wayne, Ind., who is serving in the National Army. Mr. Gaskill sent an address to the association which was read at the opening session by Mr. Flandreau. In response, the association transmitted a message to President Gaskill. Messages also were sent to A. L. Pierce, Wallingford, Conn., and George E. A. Fairley, Baltimore, who likewise are in military service.

President Gaskill, in his address, expressed the opinion that the association did the wise thing in holding its convention, notwithstanding the fact that many other similar organizations had abandoned their meetings this year. In this connection he said:

"There is no doubt in my mind that we as a national association can be of immense benefit to our country. The part we have as individuals will probably depend on our respective abilities. To some it will mean remaining in our present positions and doing better than ever before. To some it will mean changing to places in the industrial world where they will be of most benefit. To others it will mean taking up arms and going to the battle front. But no matter what part we as individuals take we shall be working toward the same definite conclusion—a world democracy."

Papers were presented as follows: C. E. Corrigan, of National Metal Moulding Company, Pittsburgh, relative to Metal Construction and Restricted

Zones wherein it is required in many cities; H. H. Reeves, of General Electric Company, on Phantom Circuit Control Systems; Frank J. Dix, Fort Wayne, Ind., on Practical City Lighting; A. L. Eustice, Economy Fuse and Manufacturing Company, took up the subject of Renewable Types of Inclosed Fuses; E. E. Salisbury, of Gamewell Fire Alarm Telegraph Company, dealt with Police Signaling Systems as Affecting Municipal Electricians; Gustave F. C. Bauer described Buffalo's New Police Signal System; C. W. Abbott, of American Conduit Manufacturing Company, Pittsburgh, discussed The Growing Tendency Toward Surface Wiring for the Sake of Flexibility and Economy in Many Classes of Buildings; W. J. Canada, of Bureau of Standards, on Fire Hazards of Domestic Electrical Appliances; J. B. Yeakle, Baltimore, Md., considered Common Battery Service Operating Fire Alarm Circuits.

W. H. Flandreau, member of the sub-committee on bare grounded-return wiring systems, offered a resolution disapproving of concentric wiring, taking the stand that such systems have demonstrated disadvantages and no advantages as regards life and fire hazards, when compared with existing system of wiring in this country; also, that they do not comply with the National Electrical Code, nor with the National Electrical Safety Code. The association indorsed the conclusions of the sub-committee and passed the resolution.

A resolution on the National Electrical Safety Code, offered by R. A. Smith, Norfolk, Va., was also adopted. It directs that every member be supplied with a copy of the code, and recommends that members request operating companies to adopt the code as far as practicable.

The Standardization committee, of which R. A. Smith is chairman, presented a preliminary report, which gives an outline of all possible activities of the municipal electrical department, encompassing fire alarm, telegraph, police signals, the construction and operating of power and lighting plants.

A telegram pledging support to President Wilson in the war crisis, which was sent by the executive committee last spring, was endorsed by the association.

Radio Enginers Hold Meeting.—The Institute of Radio Engineers held a meeting September 5 in Engineering Societies' Building, New York City. Prof. L. A. Hazeltine, of Stevens Institute, presented a paper at this session on "Oscillating Audion Circuits," which constituted an elaborate study of these circuits and their useful application.

CO-OPERATION IS KEYNOTE OF NORTHWEST ASSOCIATION CONVENTION.

Joint Meeting with Contractors and Dealers Establishes New Era on Pacific Coast—Many Important Central-Station Topics Discussed.

The tenth annual convention of the Northwest Electric Light and Power Association, which has just concluded its session at Spokane, will go down into the history of the electrical industry in the Northwest as a distinct advance in affairs electrical in that section of the country not only as a gathering, strong and enthusiastic, in numbers, but also as a gathering where the serious aspects of national life were considered for contributing effective and helpful aid toward forwarding the prosecution of the task now before the nation in so far as electrical generation and service enter as determining factors.

The meeting was called to order by President M. C. Osborn promptly on schedule time Wednesday morning at ten o'clock in the beautiful Hotel Davenport.

The president, in well chosen words, called attention to the serious aspects of the electrical industry in relation to world affairs and asked the convention delegates to rise and sing the Star Spangled Banner as the great flag at the head of the hall was unfurled by two boy scouts appropriately dressed for the occasion.

President Osborn in his address dwelt upon the fact that, due principally to the increased activities of the industry, it was felt by all in position to know, that the central stations, both in the larger cities and in the towns of the Northwest, were on the eve of a long season of unusual prosperity and activity.

There were in attendance at the convention over 250 delegates and guests. The second annual convention of the Washington Association of Electrical Contractors and Dealers was also held simultaneously in Spokane. Several of the meetings were joint sessions with the Northwest Electric Light and Power Association.

Perhaps the greatest outstanding feature of the convention was this evident growth in a spirit of get-together between all members of the industry—the central station, the contractor and dealer, the jobber and the manufacturer.

After conclusion of this preliminary session on Wednesday, September 12, the convention again convened promptly at two o'clock in the afternoon, when the reading and discussion of an exhaustive paper on "Practical Central-Station Salesmanship," by L. A. McArthur, chairman-editor, assisted by George

Group at Convention of Northwest Electric Light and Power Association—Left Half.

Bowen, S. H. Hoag, W. H. Lines, Lewis A. Lewis, and C. R. Young, took place. This paper clearly defines the field and policy of a power company in the sale of appliances. Emphasis is placed on advertising, appliance value as cost, plans for selling ranges and approved methods of operating an electric store.

In the discussion W. R. Putnam of the Utah Light and Power Company brought home the necessity of injecting consideration of the "kiddies" into the plans for a sales campaign, as their interest once aroused, he claimed, will add greatly to the gaining of entrance in the home for extended installations of household appliances.

"How the Engineer Can Assist the Commercial Department" was the subject of the session on Thursday morning. This paper, by D. F. Henderson, chairman-editor, and G. L. Duffy, H. C. Henkle, A. S. Hall and L. T. Merwin, is filled with valuable data on the distribution system requirements of various appliances, including ranges and water heaters. Cost figures are a prominent feature. The gist of the arguments is that the engineer's figures of construction costs and his co-operation in reducing them should be the basis of all new-business efforts.

The discussion that followed brought out the fact that the cultivation of intimate relations between the commercial and engineering departments is very essential. As one of the members put it, he always invited one of the engineers to go with him when he went fishing instead of a man from his own commercial department. In other words, whether it be called co-ordination or synchronism, the closest co-operation between engineering department and commercial department brings the best results.

Co-operation in House Wiring.

On Thursday afternoon A. C. McMicken, H. H. Schoolfield, L. R. Grant, F. O. Broili and Foster Russell presented a paper on "Co-operation in Modern Home and Apartment-House Wiring." This shows that in the past no concerted effort has been made to increase the number of baseboard outlets in new houses and apartments. Suggestions are given whereby central stations may secure the co-operation of architects and contractors to this end.

This session, composed also of the delegates to the second annual convention of the Washington Association of Electrical Contractors and Dealers, proved a most lively one. The discussion emphasized that education of the architect to the needs of modern house wiring was not only an excellent thing, but Mrs. Cooley, one of the women delegates, most forcefully pointed to the necessity of educating the consumer in the method electrical. This, she claimed, could best be brought about by teaching the children in the schools the many uses of electricity.

On Thursday evening F. D. Fagen, Pacific Coast manager of the Edison Lamp Works, gave an illustrated lecture on "Commercial and Residential Illumination." Beautiful slides and motion-pictures were exhibited by the lecturer who set forth in an interesting and entertaining manner the essential features of correct and artistic illumination.

Electric Cooking Discussed.

"The Report of the Electric Range Committee," W. R. Putnam, chairman-editor, occupied Friday's sessions, both morning and afternoon. This included the report of several subcommittees—"Merchandising," "Possible Improvements," in burners, ovens and general design of ranges; "Routine," handling of orders, billing, maintenance and follow-up work; "Commercial Baking and Cooking," including qualifications and compensations; "Advertising" and "Electric Water Heating."

Papers were also presented on "Comparative Tests of Cooking Fuels," by B. L. Steele, and "Busbar Density of Ranges," by H. B. Peirce. The paper of Professor B. L. Steele, who is professor of physics at Washington State College, was generally considered the best piece of scientific information presented at the convention, and points conclusively to the ultimate economic triumph of the electric range in many districts of the West.

In the discussion M. C. Osborn, president of the convention, who is commercial agent for the Washington Water Power Company, quoted statistics from the intensive range campaign initiated by his company some months back, which goes to indicate that the company is well in line for the installation of the 10,000 ranges by 1922, according to its slogan adopted at that time. He stated that out of 800 ranges installed, upon which data had been kept, only four had been returned as unsatisfactory, although about 50 had been returned for financial and other reasons. He also stated that his company was absolutely convinced, after many months of careful investigation, that a good electric range properly installed is economically far above any other type of range, at least according to conditions prevailing in his territory.

The banquet on Friday evening and the trip to the Bunker-Hill & Sullivan mine on Saturday were participated in by both the Power Association and by the Contractors and Dealers. The joint banquet proved to draw out a closer spirit of co-operation for future work, while the trip to the great mine was a real edu-

Group at Convention of Northwest Electric Light and Power Association—Right Half.

cation in the trend of modern electrical application to mining, since this mine is not only the largest lead-silver producer in the world, but it is superbly electrically equipped, driven by electric power from the Washington Water Power Company's lines.

ELECTION OF OFFICERS.

The new officers elected for the two organizations for the coming year are as follows:

Guy W. Talbot of the Pacific Light & Power Company, Portland, was the unanimous choice for president of the association at the closing session of the convention. Portland was selected as the city to entertain. Other officers unanimously elected by the convention are:

J. S. Thornton, Raymond, vice-president for Washington.

W. E. Coman, Portland, vice-president for Oregon.

William Wallace, Boise, vice-president for Idaho.

J. F. Roche, Butte, vice-president for Montana.

J. B. Faulkner, Olympia; George E. Gramb, Wenatchee, and B. A. Bertrand, Aberdeen, members of the executive committee for the three-year term ending 1920.

Louis A. McArthur, Portland, and H. L. Waither, Medford, Ore., members of the executive committee, to fill the unexpired terms of Messrs. Davidson and Kinkan.

The afternoon session of the convention was given over to the hearing of the report of the committee on ranges and water heaters.

OFFICERS OF CONTRACTORS' ASSOCIATION.

The Washington Association of Electrical Contractors and Dealers held a closing session in the Moorish room and elected the following officers: V. S. McKenny, Seattle, president; J. J. Agutter, W. M. Meacham and S. Hepler, vice-presidents for the Spokane division; H. C. Rothbach, vice-president for the Tacoma division; J. R. Martin, vice-president for the Bellingham division; Ralph Wiseman, vice-president for the Yakima division.

William E. Chase of Spokane was selected to represent the association on the Pacific Coast conference board.

NEW CO-OPERATIVE COURSE AT MASSACHUSETTS INSTITUTE.

Students Spend Part Time at General Electric Works and Are Trained for Executive Positions.

It has been the constant endeavor of President Maclaurin of the Massachusetts Institute of Technology to bring this school into the closest touch with the industrial world. More and more in the different departments there have been selected lines of work which shall introduce experience and actual practice of the professions taught, and this has been accomplished by relationships with commercial enterprises which permit study and investigation in large manufacturing establishments. The latest of these co-operative enterprises to be known as Course VIA, is that which has been undertaken jointly by the Institute and the General Electric Company. This is a proposition which on the side of the students gives to them the advantages that an enormous industrial plant with its methods and problems will afford and at the same time the General Electric will reap the benefit of the services of a group of selected young men with the broad educational foundation that Technology insists upon and the special training that the Lynn shops are well fitted to give. These students will find themselves placed instantly on the completion of their school work while the company will have at its disposal for its own business the services of men technically trained whose thoughts and energies have for a number of years been focussed on the processes and problems peculiar to the manufacture of electrical devices.

The co-operation is different in its nature from the other ones that the Institute has entered into. The Chemical Experience courses which have been pursued the past year in five great manufacturing centers, each one fundamentally different in the principles of its work from the others, give to the students in chemistry an actual knowledge of numerous processes, making of them well-rounded industrial chemists. The corporations receive the benefit of different groups of keen young minds looking sharply into their different processes.

The new course in electrical engineering lies in a somewhat different line from the others. Its object is the training of leaders for engineering and administrative branches of electrical and related industries. The course affords a distinctive training for technical and executive responsibilities with manufacturing corporations, and particularly electrical ones. The course covers a period of three years of co-operative engineering and administrative training, and the requirements for entrance into the course are the completion of work equivalent to the first two years of the Electrical Engineering Course at the Massachusetts Institute of Technology. This equivalency is obtained by college students who take their Bachelor of Arts or Bachelor of Science degree while specializing in mathematics and physics, as well as by pursuing the first two years of the electrical engineering course at technology. Consequently, such college graduates who are prepared to enter the third year of the electrical engineering course of the Institute, as well as students who have satisfactorily completed the first two years of the electrical engneering course at the Institute or its equivalent elsewhere, are eligible for this new course.

The three years of the co-operative instruction are equally divided between courses under the faculty at the Institute in Cambridge and employment under special foremen instructors at the Lynn works of the General Electrical Company. In order to secure continuity of work at both institutions, each group of co-operative students is divided into two sections, one being at the Institute of Technology while the other is at the Lynn works and vice versa. These two groups of students alternate in periods of approximately four months duration, this period having been selected so as to enable co-operative students to take courses at the Institute of Technology in the regular terms of the Institute and with the established classes of the Electrical Engineering Course. These students receive much special advanced instruction at the Institute.

While working in Lynn the co-operative students receive compensation as regular employes. The first two of the three years of co-operative work include instruction at Technology which is substantially similar to the junior and senior years of the Electrical Engineering Course at the Institute, and also give important experience in machine work, insulating, drafting, designing, testing and administration at the works. The last year of the co-operative course is given up to special research problems at the works and advanced instruction in the courses leading to a Masters' Degree at the Institute.

NEWS NOTES

New Officers of Iron and Steel Engineers' Association.—At the meting of the Association of Iron and Steel Electrical Engineers, which was held at Philadelphia September 10 to 14, the following officers were elected for the ensuing year: President, C. A. Menk; first vice-president, S. C. Coey; second vice-president, D. M. Petty; secretary, John F. Kelly, and treasurer, James Farrington. A report of this convention was published last week.

Electric Power Exports to be Investigated.—The Canadian Government has appointed Sir Henry Drayton, chairman of the Board of Railway Commissioners, Canada, royal commissioner to investigate the present exportation of electric power by companies operating on the Canadian side of the Niagara River into the United States. The inquiry will cover all power generated at Niagara Falls, Ontario, and is due to the assertion of the Hydro-Electric Commission of Ontario that power indispensable for Canadian industries is being exported.

Steam-Electric Plant for Oil Refinery.—Sinclair Refining Company, Conway Building, Chicago, has plans partly made for an oil-refining plant at East Chicago, Indiana, in which there will be required five 600-horsepower boilers, three 4000-kilowatt turbo-generator sets, and a considerable number of motor-driven pumps for handling oil. In the proposed plant a large volume of low-pressure steam will be required, and this will be obtained either by bleeding from intermediate stages of the high-pressure turbines, or by using their exhaust steam.

Electric Railway Conference Announced.—A conference of the American Electric Railway Association will be held in New York on October 9. The conference will take the place of the regular annual meeting of the association. Among the subjects which will be discussed at the meeting will be: "Is the 'war bonus' practicable as a means of wage adjustment in the electric railway industry?"; "Female substitutes for male employes;" Pending "applications for fare increases in New York state"; "Methods for increased fares by transfer charges, increased fares for present zones, and limiting zones." The subjects are all directly related to problems facing the electric railways during the war.

Electric Utility Officers Are Elected.—At a meeting of the directors of the Lehigh Navigation Electric Company and the Harwood Electric Company, Hazleton, Pa., recently acquired by the Lehigh Power Securities Corporation, under the ownership of the Electric Bond & Share Company, New York, the following officers were elected: Lehigh Navigation Electric Company—President, G. E. Claflin, succeeding S. D. Warriner, resigned; Secretary and Treasurer, C. M. Walter, succeeding Henry H. Pease. Harwood Electric Company—President, P. B. Sawyer, succeeding S. D. Warriner, resigned; Secretary and Treasurer, C. M. Walter, succeeding Henry H. Pease. Directors of the companies elected at the meeting include S. Z. Mitchell, P. B. Sawyer, G. E. Claflin, J. B. Crane, C. M. Walter, William Darbee, E. K. Hall, E. W. Hill, Samuel D. Warriner, L. A. Riley and Edwin Ludlow.

Licenses Required for Export Articles.—The Exports Administrative Board has made up a list of articles for which Government licenses are required for shipment to enemy countries, their allies, and to countries occupied by them; also, to certain specified neutral countries. This is in accordance with the President's proclamation of August 27. The list is published in Official Bulletin, issued by Committee of Public Information, Washington, D. C. Under the head of Electrical Equipment, all types of generators are included. It includes a list of chemicals, copper and copper products, coal, coke, food stuffs, and such materials as potash, nitrates, phosphates; and iron and steel structural fabrications. The list is a long one and will be required by all exporters.

Electric Wiring at Camp Travis Army Cantonment.

Electric wiring for the National Army cantonment at Camp Travis, near San Antonio, Texas, is requiring 275 miles of copper wire. Material for the overhead lines is thus summarized: No. 4 weatherproof wire, 23,000 pounds; No. 6 weatherproof wire, 14,000 pounds; No. 8 weatherproof wire, 7000 pounds; cedar poles, 700.

The requirements for the interior wiring are approximately 22,000 incandescent lamps, 11,000 porcelain receptacles, 11,000 rosettes, 11,000 brass key-sockets, 1,000,000 feet No. 14 rubber-covered wire, 50,000 feet No. 10 rubber-covered wire, 45,000 feet type P lamp cord, and 175,000 pairs porcelain cleats.

Power for the service required is being furnished by the San Antonio Gas & Electric Company.

New York Jovian League Holds First Meeting of Season.—Some of the details of how New York City investigates its own affairs were told by Deputy Commissioner of Accounts Clarence King, at the first fall meeting of The Jovian League of New York, Wednesdey, September 12. John F. Gilchrist, vice-president, the Commonwealth Edison Company, Chicago, was a visitor and spoke upon the part the electrical industry is playing in the great war. President Arthur Williams presided. A volunteer committee of fifteen was asked for to carry on the league's part in securing subscriptions to the second Liberty Loan. Tentative arrangements were made for a luncheon to be given to visiting delegates to the annual convention of the Jovian Order, to be held at the Hotel McAlpin, New York, October 23.

Indiana Commission Rules Against Utilities.—Indiana Public Service Commission in applications of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company for higher rates, decided that a contract between the utilities and the city is not binding on the Commission where the Commission acts to change service rates. The Commission ruled that the companies might increase wholesale power rates 5 mills per kilowatt-hour, but denied the companies the right to increase domestic rates. Among the large consumers was the city of Indianapolis, which had been enjoying a rate of 2½ cents per kilowatt-hour. "Any agreement between the city and the utilities is not binding on the Commission," stated E. I. Lewis, chairman for the Commission, in the decision. "The public utility law does not contemplate and specifically prohibits discrimination as among certain classes of users of service." A number of other utilities having rate applications pending which are affected by contracts made with municipalities may be affected by the ruling of the Indiana Commission, which is considering each case separately.

Notes on Commercial Practice

New-Business Methods, Policies, Rates and Kindred Central Station Matters for the Man Engaged in Selling Electricity

Cooking Diplomas Convert Negro Servants to Electric Range.

Selling electric cooking service in the South presents problems somewhat different from those encountered in other sections. Chief among them is the colored cook—a fixture in every family. In the average Southeastern home the black "Mammy" is mistress of the kitchen, and is consulted by the family before kitchen equipment of any kind is purchased. Discarding their old stove for the more modern electric range is a big step for most families; and very often the cook's opinion of electric cooking proves to be the deciding factor in the sale of a range. Obviously, no electric cooking campaign—no matter how carefully conducted—can succeed unless the good-will and cooperation of these servants are secured. It was this angle of the sales problem that was discussed in a recent meeting of central-station men at Richmond, Va. One of the best plans for converting colored servants to electric cooking proved to be the giving of diplomas in electric cooking to these servants for attaining a certain degree of proficiency in the operation of an electric range. Anyone who understands the Negro's character can readily realize their pride in possessing one of these engraved documents, and the efforts they would make to earn one.

The rate question was the subject of some of the papers read at the meeting, and much valuable information was secured by those who were still undecided as to the proper cooking rate. The water heating problem was also discussed. It was shown that the three-point type of heater, the maximum consumption of which is 750 watts and the minimum 167 watts, could be economically operated by the average family if a reasonable rate was provided. A rate of 1¼ cents per kilowatt-hour was advocated for this class of service. A double-throw switch should be installed to prevent the water-heater and range being used at the same time, and some companies make a practice of putting a clause in the customers' contract prohibiting the use of the water-heater during the evening peak.

Hattiesburg Greets Army with Two New Signs.

Under the leadership of the Hattiesburg (Miss.) Traction Company, a fund was raised among the merchants of the city to pay the cost of erecting a "Welcome" sign for the soldiers, 30 feet long, in front of the court house, and in a position where it can be seen for five blocks south. Above the welcome sign is a six-foot electric American flag.

The second new sign in Hattiesburg is above the city's slogan sign and reads "Camp Shelby." This will inform strangers that Hattiesburg is the site of one of the militia cantonments.

Continuing the precedent established at the time of the erection of the "Hub City" sign, the Hattiesburg Traction Company will furnish free of charge the electric current to illuminate the Camp Shelby sign.

Commonwealth Edison Summer Appliance Campaign Breaks Record.

O. R. Hogue, head lighting agent of the Commonwealth Edison Company, Chicago, reports that the summer campaign for the sale of electric flat irons, toasters, percolators and egg cookers, which ended September 15, reached the net total of 20,000 pieces placed in Chicago homes. Of this number, 16,500 are electric flat irons.

During the progress of the campaign about 10 per cent of the total number of irons put out were returned, a very low proportion considering that every iron was put into a home without previous request from the household and that each had the privilege of ten days' free trial without obligation to buy.

The company's lighting income will be increased by about $100,000 a year by the revenue from the use of these additional 20,000 pieces.

Four wagons were used this year, instead of three as previously, and a force of salesmen averaging about 50 worked with them in the residence districts all over Chicago, outside of the more exclusive neighborhoods for which this sort of campaign is not designed. It is the point that these sales were made in homes of average moderate circumstances that makes it so particularly valuable, and explains the fact that the sale of electric utensils at the electric shop and branch stores, instead of being interfered with by the campaign, are rather stimulated and increased, as the people of greater wealth prefer to come down town and

One of the Wagon Crews in Commonwealth Edison Campaign.

buy their own goods in their own way, and the campaign stimulates this trade.

The actual sales profit realized on this campaign will approximate $10,000.

The success was achieved with a frequently changing force of salesmen, most of whom were exceedingly "green" and many of whom stuck to the job for a few days only, the department taking any applicant irrespective of previous electrical experience.

GOVERNMENT ENDORSES ALCOHOL FROM WOOD WASTE.

Use of Sawdust for This Purpose Improves Opportunity for Central-Station Service In Woodworking Plants.

Although the many advantages of central-station service apply as well to wood working plants as in other industries, it has been comparatively difficult for utility companies to make much progress in this field because of the wood waste which is available for fuel. This question has been solved in countless instances by the re-arrangement of the boiler room so that the refuse is used to furnish heat for building and dry kilns, by the sorting of refuse and its sale, etc. However, there are a great many establishments which appreciate the advantages of purchased power but cannot ignore the vast amount of wood waste for which, in the past, there has been no market.

It is of interest to central-station power engineers to note that the Forest Service of the United States Department of Agriculture has investigated the possibilities of producing ethyl alcohol from wood and reports that the resultant product is entirely satisfactory. A report just issued by the Department says, "There is no reason for discriminating against ethyl alcohol made from wood in favor of that from grain or molasses. The amount of impurities in commercial ethyl alcohol is very small, and the impurities are probably less objectionable when wood is used as a base than when grain or molasses is used."

The prejudice against the use for some purposes of ethyl alcohol made from wood is probably accounted for, the experts say, by a confusion with methyl or "wood" alcohol, which is poisonous. Both products are derived from wood, but are radically different. The ethyl, or grain alcohol, is made by reducing the wood to sawdust, treating the sawdust with an acid to produce chemical sugars, and converting the fermentable sugars into alcohol by fermentation, as in the case of grain or molasses. Wood alcohol, however, is obtained by condensing certain gases which are liberated when the wood is heated in air-tight retorts, so that it decomposes without burning.

Ethyl alcohol has, it is stated, been commercially manufactured from wood for several years in this country. It is suitable for any use to which ethyl alcohol from any other base is put. Improvements on the processes which have been developed at the Forest Products Laboratory have made it possible to decrease the former cost of production.

Trial Appliance Campaign Instituted by Louisville Company.

Plans are being made by the commercial department of the Louisville Gas & Electric Company for a trial appliance campaign among the rural subscribers on existing lines of the company. This is a part of the campaign in connection with the recently announced three-cent rate on excess domestic consumption and will be applied to rural customers. A part of the territory south of the city, containing numerous farm homes as well as the homes of commuters, has been selected for the trial drive. It is considered that the farmer is a good prospect not only for the usual household appliances but that every farm ought to have an electrically operated pump and at least one motor for utility work. There are many gas engines in operation on the local farms and there does not seem to be any good reason why these cannot be replaced with motors.

Electric Stoves Provided in Municipal Kitchens.

City officials of Santa Monica, Cal., have devised the novel idea of providing municipal kitchens for the tourists and other visitors who may happen to spend even the shortest time in their community. Probably the most novel feature about these kitchens is the electric stoves, there being one of these to each kitchen. When

Public Kitchen Employing Electric Range. Energy is Supplied Free.

desiring to prepare a meal or boil a pot of coffee the tourist has but to switch on the electricity and the "juice" does the rest. There is no charge made for the electricity used, the idea being to furnish everything to the tourist free of charge.

In connection with each of these kitchens are several tables with benches and each has a sink with running water, where fish, caught on the municipal pier, may be cleaned or dishes washed. One of these picnicing outfits is located far out on the pier, where the tourist may enjoy a "sea voyage" while partaking of the repast.

Central-Station Service Supplants Private Plants in Youngstown.

The Mahoning & Shenango Railway & Light Company, Youngstown, O., has entered into a contract with the Linde Air Products Company, manufacturer of oxygen, for the complete electrification of the company's new plant which will start operations in that city within a short time. The Mahoning & Shenango also has entered into contracts to supply all the power requirements of the Hercules Powder Company, approximately 300 horsepower, and of the National Sand & Stone Company, approximately 125 horsepower. In these two contracts central-station power supplants the companies' steam power plants.

Arkansas Valley Company Secures 500-Horsepower Contract.

The Arkansas Valley Railway Light & Power Company, Pueblo, Colo., will furnish electric energy amounting to from 300 to 400 horsepower in motors for the operation of the Holly Sugar Company's plant at Swink, Colo. The new ink mill to be constructed at Canon City will also be served by the Arkansas Valley Company. Its original requirements will amount to 100 horsepower in motors.

Massillon Lighting Campaign Results in Sales to 54 Out of 90 Prospects.

In a three weeks' commercial lighting campaign at Massillon, O., R. J. Kennedy, lighting specialist of the Doherty organization, sold 29 varieties of installations, comprising 54 installations, or more than 60 per cent of the total stores in Massillon.

This brings his total sales to date in Massillon 199 fixtures and lamps, with a wattage of 69,600. The sales price of the fixtures complete was $3,011.80, and the total wattage increase over the old installations was 33,930.

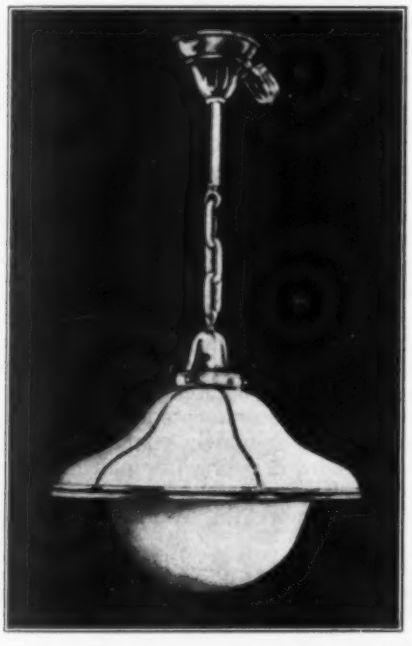
There is no question but that the Massillon merchants appreciate Mr. Kennedy's work. One department store had a curious assortment of fixtures hung on the ceiling, and the owners declared that they were all through experimenting with electric lighting. They asserted that every time they changed their fixtures, their lighting bills increased. It took two weeks to cajole these department-store owners into allowing a demonstration of the "Four-in-One" fixtures. That was sufficient and they immediately closed for an installation, admitting that the lighting was much better and the appearance of the store greatly enhanced.

A New Store-Wiring Plan Adopted by Brooklyn Company.

The Brooklyn Edison Company, on September 1, announced the inauguration of a new store-wiring plan for equipping old stores in Brooklyn.

Easy monthly payments, at the rate of $1.00 per unit installed, bring the proposition within the easy reach of every unwired store—no matter how small.

Four attractive and efficient store lighting units have been selected from over a dozen samples submitted. These four are shown to good advantage in a descriptive booklet now being distributed to all store wiring prospects. Two pages of this booklet are shown herewith.

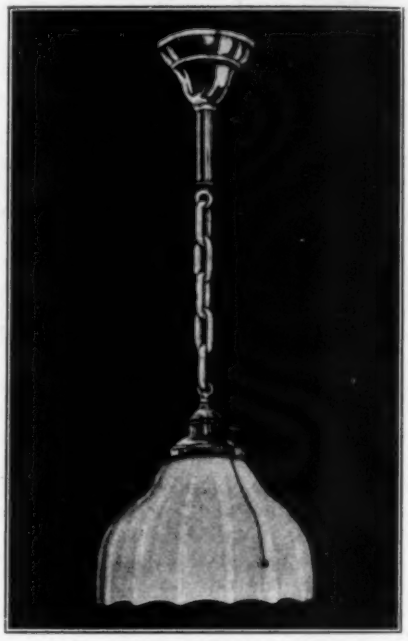


This Fixture Equipped With 200-Watt Lamp is Sold for $12.27, Including Wiring.

Initial payments have been made as small as possible spreading the balance, at the rate of $1.00 per unit, over from nine to ten months.

The prices include a complete store-wiring equipment, all ready to light, consisting of the necessary wiring, chain fixtures, a choice of four types of glassware, and 100 or 200 watt Type C Mazda lamps.

The customer may select his own contractor, the company paying the contractor in full on completion of the work, carrying out the same idea as in the Edison house-wiring plan which is so successful.

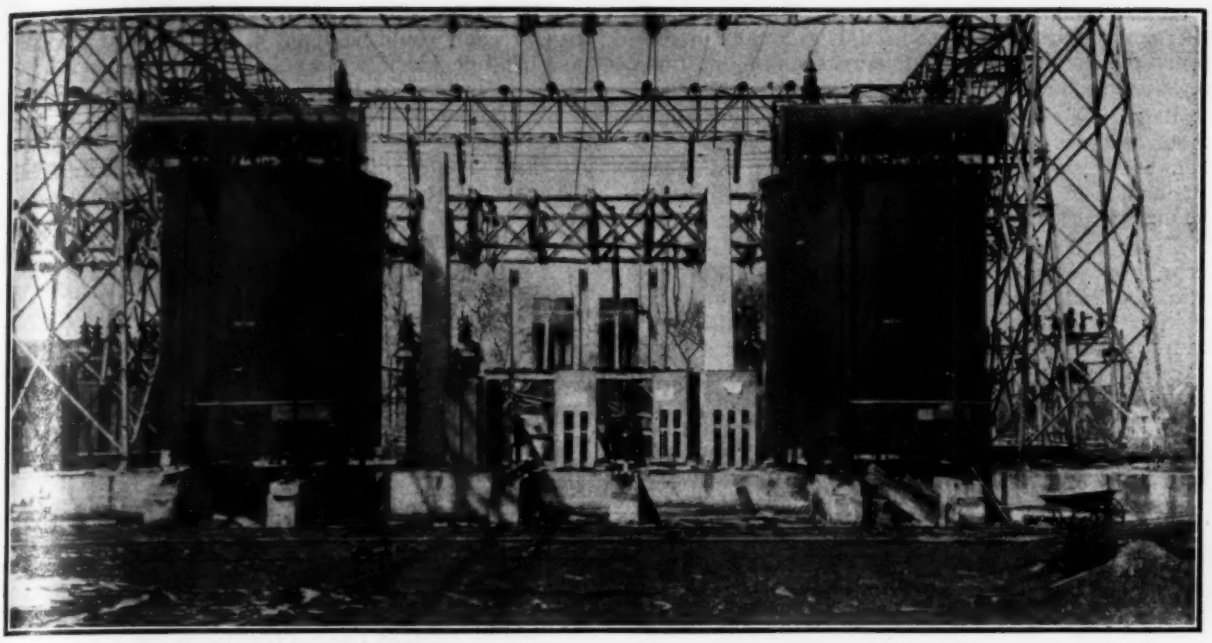


This Fixture Equipped With 200-Watt Lamp is Sold for $10.32, Including Wiring.

Kalispell Company Extends Electric Service to 42 Ranches.

Irrigation in the Flathead Valley of Montana by means of electric pumps is receiving more and more attention each year. During the present season, which has been unusually dry, a number of ranchers who operate pumps for irrigation have harvested enormous crops as a result of their foresightedness. These pumps are operated electrically with energy furnished by the Northern Idaho and Montana Power Company, which is now extending similar service to 42 other ranches in a 4000-acre tract just west of Kalispell. Besides irrigating, farmers will use electric power for grinding feed, sawing wood, separating milk, lighting barns, etc. A number of other agricultural districts have petitioned the company for electric service and investigations are being made. In an article on the subject by P. N. Bernard, in a Kalispell paper recently, the following paragraphs appeared.

"Flathead County has lost this year through drought more than the installation of electrical energy on our farms would cost. The alfalfa crop in the Flathead is thoroughly established as well as sweet clover and red clover. The feeding values are also established. These are no longer problematical. The Flathead is gradually, yes, rapidly, going into alfalfa. This means dairying, stock raising, diversified and intensified farming. It means that farms are going to raise double the amount and that there need be no short crops.



Notes on Operating Practice

A Department Devoted to Practical Problems of Plant and Operating Practice With Particular Reference to Electrical Generation and Distribution

SERVICE CONNECTIONS FOR ELECTRIC-RANGE INSTALLATION.

By D. F. Henderson.

There is probably no part of the central stations' activity where the commercial men and the engineering men need to be in closer touch with each other than in the pioneer work of introducing electric ranges and water heaters. The central station comes into more intimate contact with its customers in supplying this class of service than it does in any other. There is also a new element introduced, in that our dealings are with women to a much greater degree than in our other business. The electric range to a majority of our customers is only a thing of the imagination and to successfully introduce it to them will require much work by the commercial men and also by the operating engineers. The operating engineers must see to it that the service supplied keeps the range sold after the commercial man has closed the actual sale. To begin with, a prospective customer under present conditions very often takes a considerable time in deciding to have a range installed, but after having once decided is very anxious to have the service at the earliest possible moment, a very natural desire, but one which may add materially to the central station's installation cost. Our present distribution systems are not designed and have not the capacity for a range of from five to ten-kilowatt demand without reinforcing. When business is brisk the work of rebuilding the lines and installing the ranges can be materially lessened by the proper routing of the work. This may mean that some customers receive service more quickly than others and the commercial man in selling the range can materially assist the engineer by using good judgment in making promises of service. As one of the most serious handicaps to the range business is the cost of handling the service and installation of the range, anything that will tend to save money along this line should be given very careful attention.

Now, as to the character of service required by electric cooking equipment, all are agreed that the service must be supplied from the regular 110-220-volt lighting mains, separate service for ranges being prohibitive in cost. In some cities the rates are such that separate meters are required, while in others all current is measured through one meter. Electric cooking appliances require good voltage and reliable service, so the best of construction should be installed. Poor service to a range customer not only means poor service to the one customer, but to his neighbors also. Fluctuations in voltage not only result in poor operation of the range, but of the lights, which is particularly disagreeable to the neighbor who does not have a range.

With the present prices of copper, in the majority of places it is cheaper to extend the primary feeders and install a transformer for range customers than to increase the size of secondary conductors. The experience of one northwest company along this line shows that the average cost of building the necessary line and running the service is about $100.00 per range customer where additional capacity in the line is required. This covers the cost of wire, transformer, poles, etc., and labor. Approximately 65 per cent of the ranges installed require additional line capacity, the other 35 per cent being located near a transformer

or on a secondary main of large size. This percentage, where no construction is required, is gradually increasing as the number of ranges increases, for one range in a neighborhood often sells another one near by.

Before we reach the point where a large percentage of our customers are using electric ranges, and we have from five to six ranges in every block, we must change our method of supplying service very materially from the present practice.

From data obtained by investigations of demand-factors on several lighting feeders in Spokane it is estimated that we may obtain a demand-factor of approximately four for groups of ranges on lighting mains. Using this value as a minimum (and we hope that the actual demand-factor will in reality be greater than this) it will be necessary to provide secondary mains in each block to provide a load of 7½ kilovolt-amperes in range load, assuming an average demand of 5 kilowatts per range. In addition to this a load of 1.5 kilowatts per block for lighting must be added, making a total load of 9 kilowatts per block, or 25 kilowatts per 1,000 feet of street. As a 30 kilovolt-ampere transformer is a good standard size for use on overhead distribution lines, good practice would indicate that a 30 kilovolt-ampere transformer be installed every thousand feet. To supply proper voltage to the service switch secondary mains of No. 0 copper would be required. The conductor cost per thousand feet of this size would be approximately $336.00 installed. (This is figured at 35 cents per pound in place; present indications are that copper will continue to be high in price for some time.) The transformer would cost approximately $200.00 installed, making a total of $556.00 for transformer and secondary mains. Transformer and secondary mains to supply the lighting load of this same territory would cost approximately $65.00 for the transformer of 5 kilovolt-amperes capacity and $84.00 for a No. 6 secondary main, a total of $149.00 per thousand feet; extra guying due to heavier conductors would amount to about $20.00 per thousand feet. The additional cost of the larger service over a lighting service and the additional cost of a larger meter is about $8.00, or $134.00 per thousand feet. The total additional cost of supplying the thousand feet of combined range and lighting load would be $556.00 + $134.00 + $20.00 — $149.00 or $561.00 per thousand feet. As we have assumed an average of 16.7 ranges per thousand feet the additional cost to serve each range customer would be $561.00 ÷ 16.7 or $33.30.

Primary feeders to supply these transformers must be provided. A one hundred and fifty ampere regulator is a convenient size, and a 4,000-volt four-wire feeder would care for approximately 900 kilovolt-amperes load to a load center 1½ miles from the station, with a wire size of No. 0 copper. From the load center the feeder would divide into three single-phase feeders and approximately 2½ miles of wire would be needed in the branch feeders. A feeder of this character would cost approximately $8750, or $2920 each, exclusive of pole lines, considering the feeder as three single-phase feeders. A primary feeder to supply the lighting load for this same territory would cost, with No. 6 copper, approximately $1200, the cost of lighting feeders being much more per kilowatt of capacity than the heavier feeder because the load is scattered over such a large territory and operating conditions would require that the feeders be confined within a reasonable territory. Deducting this from the cost of the heavier feeders gives an added cost of $1720 for the range load.

The demand-factor of the ranges supplied by this larger feeder would be about 5. Reducing this to the basis of one block we would have a demand of 6 kilowatts instead of the 7½ kilowatts as in the case of the seconardy mains. Adding to this the 1.5 kilowatts lighting load gives us a total of 7½ kilowatts per block or 20.8 kilowatts per 1000 feet. Each single-phase feeder is sufficient to carry a 300-kilowatt load and would serve a territory having $\left(\frac{300}{20.8}\right)$ 14,400 feet of secondary main. As we have assumed a density of 16.7 ranges per 1000 feet this feeder would supply $14{,}400 \times 16.7$ or 235 ranges. This gives us a cost per range $\frac{1720}{235}$ or $7.30 additional to the cost of lighting service. This makes a total conductor expense additional to lighting service of $33.30 + $7.30 or $40.60 per range.

The above figures cover the necessary feeders, transformers, secondaries, meters, etc., to supply a mixed lighting and range load at the time the range load has reached a density of six 5-kilowatt ranges per city block. The time that will elapse before this density will be secured has a great bearing upon the determination of the type of construction that should be installed at the present time. This load is being built up gradually, a range here and a range there, and our problem is to decide on the best course to follow. As explained earlier in the paper, present practice of most companies is to run small primary wires and install small transformers at or near the point where the range service leaves the secondary mains, at a cost of about $80 per range on the lines. The difference in cost between the two methods does not necessarily mean that it will cost that much additional per range when the total number has been installed, for as the territory becomes saturated a large number of these transformers will be removed and a part of the copper replaced and considerable salvage will be secured, but there is no doubt that the present method is the more expensive one and the difference is great enough to warrant the various companies in making a very exhaustive survey of their system and determine the procedure to be followed. To make an estimate of the growth of the range business will require that the commercial men and the engineers work together on the problem and give their best thought as to the time and place where range load may be expected.

Frequency Changer in Central Station Saves Traction Service.

In the course of hearings on the cost of lighting of Boston streets by the Boston Edison Company, objection was made to the investment in a 9,000-kilowatt frequency changer which the Edison Company installed several years ago to supply the Boston Elevated Railway Company with 25-cycle energy. It was objected by representatives of the city that the use of the apparatus did not justify the cost, and hence the installation was a burden on the city and other customers.

Later in the course of hearings F. M. Ives, attorney for the Edison Company, stated that during the week of March 20 the frequency changers had been in use twice, once to the extent of 7,000 kilowatts, and again to the extent of 5,000 kilowatts.

On the first occasion, it was stated, the railway company would not have been able to operate its cars during the peak load of the early evening except for

the assistance given by the central-station company. The elevated company's own station was hampered by low steam due to bad steaming conditions.

On the other occasion one of the railway's large generating units broke down.

The placing of the large rotary is evidently an act of good judgment on the part of the Edison Company, and is a valuable adjunct in the operation of Boston's transportation system.

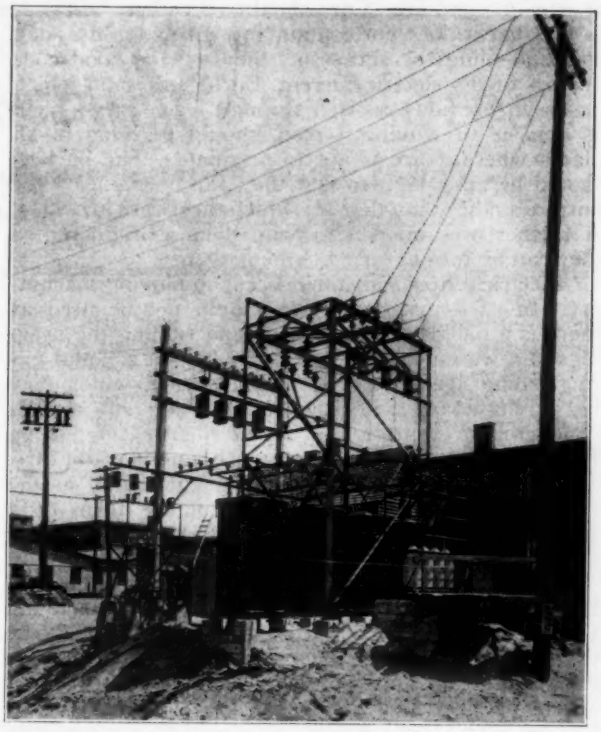
NEW OUTDOOR SUBSTATION AT ROCHESTER.

Inexpensive Type of Construction Employed—New Lines to Be Built Later.

The new outdoor substation of the Rochester (N. Y.) Railway & Light Company, at East Rochester, which is fed from a 11,000-volt, 60-cycle transmission line emanating from Station 1, has just been switched into service. This line runs under ground as far as the Rochester, Syracuse & Eastern right-of-way at Rockwood Street, where it rises and is carried on "boarrow" overhead construction along the railroad to East Rochester. The line is protected by electrolytic lightning arresters of the outdoor type at Rockwood Street and at the substation. There is also an overhead ground wire along the entire length of the line. The new substation has a capacity of 1500 kilovolt-amperes and also a spare 500-kilovolt-ampere transformer, and will serve East Rochester and vicinity through two mixed light and power 4100-volt circuits, and one straight power circuit.

These circuits are controlled by pole switches and are protected by oil fuse boxes. It is planned to later build a small fireproof building in which will be installed the metering equipment, oil switches and street-lighting transformers.

View of 11,000-Volt Line Rising From Underground at Rockwood Street. From This Point It Is Carried Overhead to East Rochester.



New Outdoor Substation Recently Installed at East Rochester The Wire Netting Was Only Temporary. The Ground Has Been Graded and An Iron Fence Now Surrounds the Structure.

The new station was designed by J. O. Montignani and installed under the supervision of Sidney Alling and F. C. Alcott.

An extension of this company's distribution system to the west is being constructed on the Buffalo Road, according to the Gas and Electric News, issued by the company. It consists of a 4150-volt, 3-phase line running west on the Buffalo Road about one mile from the B. R. & P. railroad subway. The primary purpose of this line is to serve the Becker limestone quarry where 150 horsepower will be delivered, but several houses along the route will also be supplied with current for lights and small motors. Over part of the route for this line the soil is only 18 inches deep and the underlying stratum is rock. To put in the pole holes with as little trouble as possible, the line will be built up to the point where the rock is encountered. The current will then be supplied over the line for an electric drill which will be used to drill the rocky section of the pole holes which must be blasted out. It is intended eventually to extend this line to Gates Center.

EXTINGUISHING ELECTRIC FIRES IN POWER STATIONS.

By K. M. Coggeshall.

Fires originated by overheated electrical machinery or short-circuited power lines are exceedingly difficult to extinguish as water cannot be used without exposing the individual manipulating the hose to the danger of an electric shock. It is, therefore, not out of place to consider briefly several methods of extinguishing electrical fires, as statistics show that the number of such conflagrations is legion.

Dry sand may be used to smother an electric arc

or even a wood fire. Care should, of course, be taken to see that it does not contain foreign materials, such as metal filings or scraps, as they will be good conductors of the electric current. Buckets of sand which has been previously sifted through a fine sieve, such as a piece of window screen, should be hung in all places where a fire is apt to originate. The buckets should be hung high so that they will not be used for purposes other than that for which they were provided. A further precaution is to paint them a bright red so they can be seen at once in an emergency.

Electrical fires sometimes occur in moving machinery. In such instances sand should not be used as there is a liability of it entering and ruining the bearings and we must therefore depend upon a liquid extinguishing agent. Carbon tetrachloride, which may be purchased at any drug store, is not only a nonconductor of electricity but an excellent extinguishing fluid; it forms a gas blanket which smothers the fire. Bicarbonate of soda will give the same result as the carbon tetrachloride, but is used in the form of a powder. Either of these two agents should be thrown at the base of the fire and not just into the flames.

Many types of electrical apparatus are immersed in oil for insulation purposes as well as to facilitate the radiation of heat. Often, due to an accident, the oil leaks from the case or is thrown out by an internal explosion in the apparatus. In such places, therefore, where oil fires may be started, it is best to have on hand a quatity of sawdust which has been previously soaked in a solution of salammoniac. Experiments have shown this to be quite efficacious in extinguishing oil fires.

In all instances it is imperative that the electric current be switched off at the earliest possible moment. The operator should be thoroughly familiar with the switchboard so that only the affected portion of the circuit is cut out in the emergency; his knowledge of the machinery under his control should be such as to guide him promptly. Do not sacrifice personal safety for the sake of saving a few dollars' worth of property; if necessary use up a minute or two in searching for the controlling switch. Watch carefully to see that there is no danger of being struck by a falling wire or coming in contact with a current-carrying conductor. Endeavor to apply the fire extinguishing agent as quickly as possible.

Coal-Storage Facilities of New York Edison Company.

To guard against a shortage of coal this winter the New York Edison Company has just completed the 222,000-ton outdoor storage plant shown in the accompanying illustration. The plant is located on the North River at Shadyside, N. J., and is arranged to handle coal from boats and railroad. A complete equipment of automatic coal-handling machinery of Link-Belt manufacture has been installed, comprising two 100-foot locomotive cranes for distributing the coal from the cars or boats to the coal pile and a cable railway for transporting the coal to the plant as needed.

Coal-Storage Plant of New York Edison Company—Capacity 222,000 Tons.

It is expected that the investment in this plant will be amply justified by insurance against shortage that it will afford as well as permitting the company to purchase in large quantities when prices are lowest.

LINE CALCULATIONS FOR SUPPLYING SERVICE TO SMALL COMMUNITIES.

Co-operation of the Engineer with Commercial Department an Essential Factor.

The importance of sound engineering calculations with relation to new business activities of central-station companies was set forth by D. F. Henderson before the recent convention of the Northwest Light and Power Association.

In building lines and supplying service to small communities a careful canvass of the prospective load is necessary. Comparisons with loads in other small communities are often of little value. An instance of this is shown by the experience of one northwest company in building into two small towns. The first town supplied was provided with a capacity of about 150 kilovolt-amperes and the actual load was about 25 kilovolt-amperes. A similar town nearby was later supplied and the experience in the first town was used in determining the load to be expected. The new town proved to be a much better town and the load very quickly exceeded the 35 kilovolt-amperes for which the line was built and business had to be refused, for the additional expense in rebuilding 16 miles of 6600-volt line was more than the additional business was worth. Capacity sufficient to care for the increased load could have been supplied at the time the line was built for a very small increase in cost of line. This illustration simply shows that a careful study of all the conditions affecting a given proposition must be made. It is of doubtful economy to so cheapen the construction of a line to a new community that it will show a return on a certain definite known load in order to get authorization for the building of the line and then later to have to refuse business or rebuild the line. If the community to which the line runs does not show that any growth will take place, it is questionable whether or not the line should be built. On the other hand, construction not warranted by the business secured should not be put in. No doubt many lines have not been built, on account of the high cost, which could have been made into paying lines had better judgment been used in making the preliminary surveys, both commercial and engineering. It is necessary for the engineer and the commercial man to get together and work out the problem to decide on the relative importance of the various items entering into the business.

In city construction, excepting power loads, the growth of the service can be fairly well estimated by comparison with other parts of the city and with past loads. Such estimates are, of course, materially affected by the frequent improvements in appliances and lamps.

Electrical Construction Notes

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

California Electrical Contractors Adopt Direct-Bid Plan.

A new policy for direct bidding on electrical work has recently been adopted by the Electrical Contractors' and Dealers' Association of San Francisco, Cal., providing for the submission of bids to the architect or owner on all electrical installations costing $500 or more, with such bids to be opened at a specified time and contract award made. In explaining the new method of operation for members, the association says:

Efforts have been made in the past to impress upon the persons and firms to whom electrical contractors submitted bids for electrical work that such bids represented considerable expense and labor and should be treated as confidential, but for some unknown reason this is not found to be the case.

In line with our past efforts, we find that the only remedy for the situation is to submit our bids to the architect or owner direct at some particular date, time and place. In order that this matter may not be unwieldy to the architect or owner, we have limited such bids to $500 or over, or, in other words, on all electrical work costing $500 or over the bids shall be given direct to the architect or owner and none other.

Accordingly, no electrical contractor member will submit any bid for electrical work, the cost of which is $500 or more, except direct to the architect or owner or his representative, who shall set a date, time and place for the receipt of such bids, and at which time and place such bids shall be opened. The contract for the electrical work shall be awarded to one of the contractors whose bid has been received at such time and place.

Louisville Contractors to Conduct Advertising Campaign to Stimulate Building.

Electrical contractors of Louisville, working in common with all of the other members of the building trades, are developing a plan for conducting an educational campaign during the winter, in which it will be sought to impress upon the people that the present is as good a time to build as will be seen for years to come. A committee on ways and means is to be named, on the authority of the combined interests as expressed at a recent meeting held at Sennings Park, one of the Louisville amusement resorts. At this meeting a report was made by a committee named previously to investigate the situation and recommend a course of action.

Herman Wischmeyer, a Louisville architect, was chairman of the reporting committee, and the report he read recommended raising by the building trades interests of a fund of $5,000 or $6,000, which was to be expended in an advertising campaign in the Louisville newspapers. It was recommended that copy be prepared and the campaign directed by an expert advertising man and that it be continued over a period of at least five or six months. The committee, which will be announced shortly, will undertake to apportion the contributions by the various members interested and then to raise the money and direct the campaign.

According to the report of Mr. Wischmeyer what is admittedly a wholesale slump in building operations in Louisville is due to two causes, first a more or less well defined disinclination to proceed with building on the idea that it would hinder the Government's war program and thus be unpatriotic, and, second, the mistaken impression on the part of the general public that building material costs have increased to a prohibitive level.

To counter this attitude the committee suggested that the Government itself is not only continuing its own building program all over the country but that the administration has definitely urged that building go on as usual. So far as material and building costs are concerned, the report asserted, they have not begun to keep up with the advances in most lines. Not only that but the chance that they will be lowered for years to come is exceedingly remote, inasmuch as about 50 per cent of the advance is on the average due to increased wages to labor which never go down, once they are raised.

The campaign will be conducted along this line of reasoning and will seek to acquaint the general public with the truth about the situation.

Among the Contractors.

The Sprang Electric Company, 214 South Seventh Street, Philadelphia, Pa., has been awarded the contract for installing a conduit and complete wiring system in six new storage buildings at the Schuylkill Arsenal. The contract price was $5,912.

The Tri-City Electric Company, Moline, Ill., has moved its place of business to the new Service Building, 1412 Fifth Avenue. With increased space, more convenient arrangement of stock and larger display rooms, the company will be better able to serve the requirements of its many customers in electrical merchandise, contracting, fixtures, and repair work for the home, office or factory than ever before. An important department of the business is the winding and repairing of motors. W. J. Ball is manager of the company.

Hubbard Electric Company, Beloit, Kansas, lately was awarded contracts for the electrical work on three school buildings and one church edifice, in Kansas, as follows: High school, to cost $20,000, at Glen Elder, to be conduit wired throughout; church, at Glen Elder, costing $8000, to be combination knob, tube and conduit, and to include a 1-horsepower motor for heating plant; a $20,000 school at Simpson, to be a conduit job, and to have a vacuum cleaner; school at Asherville, to cost $20,000, to be wired on the knob and tube plan. Architects for this work were C. D. Turnbull, Junction City, for the first three buildings, and Frank A. Slack for the last named.

Selection, Installation and Testing of Carbon Brushes

Expert Should Select Brushes for Any Particular Class of Work —Brush Installation Can Be Made by Following Suggestions Given—Change Only One Condition at a Time in Testing

By E. H. MARTINDALE

Chairman, Industrial and Domestic Power Committee, A. I. E. E.

This is the last of a series of fourteen articles on commutator and brush troubles and their solution. The series began in the issue of March 24 and has appeared at intervals of two weeks. These articles have given a comprehensive and detailed discussion of commutation troubles, and explained how these may be avoided or overcome. In this concluding article Mr. Martindale gives valuable suggestions on applying new brushes. In the conclusion it will be noted that he offers to answer questions relative to the use or manufacture of brushes. Any of our readers desiring to avail themselves of this opportunity should address Mr. Martindale in care of the Editor, ELECTRICAL REVIEW, *Chicago.*

THE selection of the proper brush for any machine is generally a matter of judgment, based on knowledge obtained by years of study of results secured by trial.

The second article of this series, which was entitled "Brush Composition and Characteristics" (issue of April 7, 1917), dwelt briefly on the effects of brush characteristics on the operation of motors and generators. Coefficient of friction, contact drop and abrasiveness are the three most important characteristics which affect the operation. The first two were discussed fully in the third article (issue of April 21). The last has been mentioned in connection with several of the articles.

Consult Experts as to Selection of Brushes.

If an operator has the time and inclination to study carefully the operation of brushes, he can in time gain such a knowledge of brushes that he can select his own brushes with accuracy.

This, however, is an age of specialists and it is generally better to accept the recommendation of an engineer who has spent years in the study of the application of brushes. Most of the carbon manufacturers maintain engineering departments for the free service of their customers. Brushes can be purchased with the understanding that if they are not in every way satisfactory after they have been tried, they may be returned for full credit.

Thoroughly Overhaul the Machine Before Applying New Brushes.

Time spent in thoroughly overhauling a motor or generator before installing a new set of brushes will be well repaid. If there has been severe sparking with unequal burning of the commutator the armature should be tested for high-resistance end connections, as explained in the seventh article of this series (issue of June 16). The air gaps should be examined and, if very much difference is found, they should be equalized either by renewing or adjusting the bearings or by shiming or grinding the pole pieces.

Examination should be made for high bars or low bars and, if any are found, the commutator bolts should be examined and tightened if they are loose. The commutator should then be ground with a commutator stone, or if there are wide flat spots or if the commutator is eccentric it should be turned or ground with a grinding wheel and afterwards finished with a stone to remove all tool marks and scratches. A good commutator stone is a selected grade of sandstone cut a certain way of the grain. It should not pick up copper, should not wear away rapidly and should have such a fine grain that particles which fell themselves will leave no scratches. Such a stone will leave the surface of the commutator smoother than any other method of finishing.

Value of Commutator Slotting.

The author believes in undercutting the mica on practically all machines. This will permit the use of a hard, low-friction brush without any abrasive action. Such a brush will have a long life and the commutator will outlast the rest of the machine. On one electric railway 369 new commutators were installed the year before commutator slotting was started, 165 were installed the next year while the undercutting was in progress. The year after this was completed only three commutators were replaced and those were on three old-type motors on which they were used to put the motors in first-class condition for sale to another road. The new brushes for the slotted commutators cost them three times as much per brush, but the total brush cost for the year was only one-third the former cost, because the life of the brushes was nearly ten times as great and the saving in maintenance costs was much greater.

Where oil or greasy dirt can not be kept off the commutator the mica can be undercut and the slots filled with cement or painted with an air-drying insulating varnish. The most convenient tool for undercutting mica for a company with less than 100 medium-size motors is the commutator-slotting file. For large installations a standard slotting machine may be more economical although some companies with more than 1,000 motors prefer the files because they can be used without removing the armature to a lathe. The use of a commutator stone for finishing the surface of an undercut commutator is more important than on one with flush mica, because the non-abrasive brushes to be used may require many weeks to remove the scratches left by fine sandpaper and to properly polish the commutator.

How to Space and Fit the Brushes.

After the commutator has been put in good condition, the brush spacing should be carefully checked. The best way is to cut a wide strip of paper a little longer than the circumference of the commutator. Place this around the commutator tightly and carefully mark where the ends lap. Remove the paper and divide this into equal spaces corresponding to the number of poles and draw straight lines across the paper at each point. Replace the paper on the commutator with one mark at the edge of one row of brushes. Set the brushes on all of the other studs to their respective marks. After this is done, carefully mark the ends of the commutator bars with a prick punch to correspond to the marks. This will make it easy to check up the spacing at any later date.

The brushes should then be carefully sanded to fit the commutator. The sandpaper can be cut in narrow strips and pulled back and forth under the brush faces with the smooth side against the commutator. Care should be taken to not let the paper bow or belly as this will bevel the edges of the brushes. A high spring pressure with coarse sandpaper pulled in both directions can be used for roughing in.

For final surfacing it is well to use approximately the operating pressure with the sandpaper pulled in only one direction. On brushes operating at any angle in a trailing position, at less than 15 degrees in a stubbing position, or in a radial position, the sandpaper during final surfacing should be pulled in the direction of rotation. For angles greater than 15 degrees in a stubbing position the sandpaper should be pulled against the direction of rotation.

On large generators with a great many brushes the roughing in is sometimes done by fastening a strip of sandpaper clear around the commutator and starting up the engine. Sandpaper for this purpose can be secured in rolls. Care must be used, as only a few revolutions of the engine are enough to surface in the brushes and any additional sanding wears them down needlessly.

Adjusting Brush Pressure and Setting.

The next point to be checked is brush pressure, which should always be maintained as nearly constant as possible. The pressure should be as low as consistent with the maintenance of a good contact between brushes and commutator. Approximately 2 pounds per square inch of brush cross-sectional area is recommended for stationary machines, 3 pounds per square inch for elevator and mill-type motors, 4 to 7 pounds per square inch for crane motors, railway motors and similar machines, depending on the speed and vibration.

After all this has been done the brushes should be set at the best point for the average load. On non-interpole machines this is usually done by putting the average load on the machine and then shifting the brushes to the point of least sparking. On some machines the armature reactions cause such a shifting of the field flux that it is necessary to shift the brushes with a change of load.

On interpole machines this method is not satisfactory as a displacement of 1/16 inch in the brush position is often sufficient to cause a motor to spark badly and to have erratic speed characteristics. The author is indebted to W. J. Warder, of Roth Bros & Company, for the following directions for setting brushes on interpole machines which were given more fully in the eleventh article of this series (issue of August 11).

The best way is to operate the machine as a series motor with only the commutating poles excited. A resistance must be placed in series with the armature to limit the current to about twice full-load value. When the brushes are set so that the flux from the commutating pole divides equally the motor will not rotate and there will be no torque tending to produce rotation. When the brushes are just about in the right position the amount of torque may be so small that it will not actually produce rotation but the torque can be felt by turning the pulley and noticing whether or not it turns harder in one direction than in the other. The brushes should be so accurately set that no difference can be noticed when twice full-load current is flowing through the armature and commutating poles.

A less reliable method is to operate the motor at no load in first one direction and then in the other. When the brushes are so set as to give exactly the same speed in both directions it means they are in the neutral of the main field. If the commutating poles are accurately assembled in the center between the main poles the brushes will also be located correctly. A third method less frequently used consists in setting the brushes by a voltmeter and was described in issue of August 11.

With the proper grade of brush the machine should now operate with complete satisfaction unless something is radically wrong with the design or with the windings.

Tests of Brushes.

When brush tests are being conducted care should be taken to make no change in the machine. Very frequently the mica will be undercut, pressure adjusted, also other changes made and the results compared directly with those secured before the changes. It should be obvious that if it is desired to test the effect of a new kind of brushes, all other conditions should remain unchanged.

The life of the brushes is one of the small items in the comparison of quality. Frequency of attention required, wear of the commutator, temperature of commutator, temperature of the windings, and freedom from carbon dust deposit, these are all more important than the life of the brushes themselves.

Conclusion.

The author desires to extend his thanks and best wishes to those who have followed this series of articles. He is happy if they have proved of any help. He will be pleased to have questions asked and to discuss further to the best of his ability, either in private correspondence or through the columns of this paper, any points in connection with the use or manufacture of brushes.

Young & Egan, Inc., 489 Fifth Avenue, New York, have received a contract from the Common Council, Newark, N. J., for the installation of lighting fixtures in the main hospital, laboratory, and other buildings of the City Hospital.

The L. K. Comstock Company, 30 Church Street, New York, has been awarded a contract by the Government for the installation of an electric lighting system in the structural shop at the Navy Yard, Brooklyn, N. Y., at a price of about $10,500.

The Board of Education, Newark, N. J., upon the suggestion of Acting Supervising Engineer West, is planning for the appointment of an electrician to devote time exclusively to the city schools. It is estimated that over $10,000 will be saved by the inauguration of such a department in experienced hands.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 401.—Transformer for Low Secondary Voltage.—Will some one kindly give in detail suggestions for building a transformer to be used on a 440-volt, 50-cycle, three-phase circuit to give 6 to 10 volts single-phase secondary, the capacity of the secondary to be from 1800 to 2500 amperes? It is to be used for supplying current to an arc for cutting cast-iron and steel plates, engine heads, etc. Would a higher voltage on the secondary be an advantage? The average thickness of cast iron to be cut is 1¼ inches; the average steel thickness is ⅞ inch. Occasionally as large an object as a solid shaft 6 inches in diameter must be cut. The transformer must be portable or semi-portable. Would oil or air cooling be better? I would like as complete details of the core construction and winding as possible.—J. B. K., Torrance, Cal.

No. 402.—Economizers and Motor Auxiliaries in Small Boiler Plants.—Is it considered good practice to install economizers in the smoke flues of a small boiler plant, say, one consisting of two 350-horsepower water-tube boilers aperating at 185 pounds pressure and supplying a 1000 and a 500-kilowatt turbogenerator? Would it be better to use economizers and operate the condenser auxiliaries and other pumps with motors, or use the exhaust from steam-driven auxiliaries for feed-water heating without economizers?—T. M. W., St. Paul, Minn.

No. 403.—Signal Circuits Run over Roof Tops of Buildings.—In quite a few large cities it has been a custom to run telephone and telegraph wires and cables from one building to another over roof tops and across streets and alleys more or less indiscriminately. Are such circuits run with consent of the insurance interests? Is it necessary to secure special city permits or are the cables installed without securing any permit whatsoever? Have such cables been found a hindrance by firemen? Is there anything in the National Electrical Code covering them? In what cities, if any, are they positively prohibited?—C. E. M., Springfield, Ill.

Answers.

No. 393.—Maintenance of Underground Lines.—What has been the actual cost of the maintenance of underground cables, conduits, etc., for series street lighting at various voltages and different systems, exclusive of electrolier maintenance? What does this maintenance consist of?—T. S. P., San Francisco, Cal.

This question regarding the cost of maintenance of underground cables, conduits, etc., for series street lighting for the various systems and voltages has remained unanswered for so long because an answer is not easily made. Different companies use different methods, the number of companies operating several methods being probably in the minority, hence a number of replies would be required to answer the question fully. In any one large company the maintenance of underground street-lighting systems is usually carried out by several departments. There is the renewal of carbons and maintenance of lamps, shades and cutouts; cable failures and extensions; repairs to poles due to accidents, pole painting and maintenance; and repair of streets and pavements. These various expenses are itemized and their summation represents the total maintenance cost, a figure available only to officials of the company concerned. These figures when available are often difficult of comparison, because of variance of expression, the cost sometimes being given as per front foot, per duct foot, per post, or per lamp per annum.

It must be obvious that in assessing its customers, whether they be private individuals, municipalities, civic organizations or merchants' associations, for street lighting upon whatever basis the utility must know within fairly wide limits what its costs are going to be, these costs including cost of energy, maintenance, depreciation and interest upon the investment, to which is added a profit. These data are available to the company charging the rates, and to the state public utility commissions controlling them, where existent. To what degree the information is accessible is another matter.

The National Electric Light Association maintains committees on street lighting and underground construction, both of whom should have a vast amount of cost data. Reference to the association's transactions of the last few years fails to show anything of much value to querist; however, much of the material on underground construction is instructive, whilst some of the data on street lighting in the various cities might be of service in following up. There is undoubtedly an enormous amount of information available through the N. E. L. A., which can be obtained by member companies; some of this is probably also accessible to others as a matter of courtesy.

Articles appear from time to time in the technical press, descriptive of various street-lighting systems. These usually cover the construction features and initial costs rather than the troubles that develop, and the cost of maintenance over a period of time. Querist will find it difficult to obtain what he wants because there is no typical installation in a case of this kind. Each case is different, and it is only by obtaining data of many installations that a fair and safe conclusion can be drawn.—K. R., Chicago, Ill.

No. 399.—Wiring Elevator Light.—What is the best method of connecting the lamp in an elevator car with the stationary wiring system of the building?—A. S. N., Plymouth, Mass.

Answer A.—An ordinary outlet box should be installed inside of the elevator shaft about halfway to the top. The circuit wires should be brought into this box. Use a substantial portable cord or armored lamp cord long enough to run from this outlet box to the bottom of the shaft. This cord should be securely fastened at both ends by means of clamps or pipe straps. At the bottom of the elevator car another outlet box is installed, into which the cord is run, and from which a piece of half-inch conduit is run up through the inside of the car to a switch condulet, then to the center of the top of the elevator.—H. D., Detroit, Mich.

Answer B.—In wiring up an elevator light, standard elevator cord must be used, which is composed of a No. 14 B. & S. flexible cord surrounded by a protecting rubber jacket with a waterproof braid over all. The cord should be 4 or 5 feet longer than one-half of total length of elevator travel. Halfway up the shaft a conduit terminal fitting or box should be placed and conected to general wiring of building. Any standard make of screw-type fittings or boxes should be used on wall of the shaft and for elevator cage. Locknut and bushing boxes are not as reliable, owing to vibration and jarring loosening locknuts and bushings. Tie knots in cord and reinforce with tape to take strain from connections; and bush boxes with either iron or porcelain; I generally recommend Chase nipples. Cord should preferably enter lower side of box on elevator shaft wall so splices can easily be made and cover secured thereon.

Secure cord underneath floor of car with a pair of large cleats or knobs for support and also to take

strain from connections in addition to knots in terminal of cord. Conductor here should preferably enter side of box, so splices can easily be made and cover replaced. The elevator cage should then be wired with standard conduit or armored cable, a snap switch located on the side of cage to control keyless receptacle or flush type socket. If preferred, use a porcelain-lined aluminum-shell socket attached directly to terminal of conduit, but by no means use any fiber-lined sockets, as they are too frail for this purpose.—A. P., Chicago, Ill.

Answer C.—Run the wires from the lighting circuit into the elevator shaft through half-inch conduit, or, if preferred, use two-wire BX cable. Install an outlet box at the side of the shaft about halfway from top to bottom. Run half-inch conduit or two-wire BX from the light in the car to an outlet box fastened to the bottom of the car near the middle. Connect the two outlet boxes together with heavy reinforced lamp cord or No. 14 two-conductor elevator cable. Have the cable long enough so that there will be three or four feet of slack when the car is at top or bottom of the shaft. Bush the holes where cable enters the outlet boxes and tape the cable in the bushing to prevent chafing. Support the weight of the cable by tying a knot in it inside the box or tape it to prevent it pulling through the bushing. A switch may be connected in by using a conduit or similar switch fitting in the conduit or BX at a convenient point between the light and the outlet box on the car. —W. D., Boston, Mass.

No. 400.—Running Cables in Mine Shafts.—What is the most approved method of installing cables in mine shafts? What special precautions should be taken in mounting the cables and protecting them?—H. R., Winnipeg, Man., Canada.

The methods employed in carrying cables through mine shafts depend chiefly upon the length of the shaft, its lining, whether the shaft contains corrosive moisture, and whether the cable must be protected against mechanical damage. For a short shaft, iron pipe is sometimes used. The cable, being thus armored, is securely anchored at the top, its flexibility being relied upon to press against the sides of the iron pipe to help hold it in place. This method is cheap, is only applicable to short shafts and in any case does not make a first-class job.

Cables in mine shafts are usually difficult to repair and require a shutdown to do so, hence their installation should be such as to lend toward reliability. Lead-covered cables are usually preferred for mechanical as well as electrical reasons. A wrapping of steel armor also is in the interests of reliability while permitting the best installation practice. The armor protects the cable against mechanical damage and helps allay corrosion, electrolysis and other chemical action. Some cable manufacturers protect their mine cables with rope and bitumen, both inside and outside in addition to the steel.

An unsatisfactory manner of holding electrical cables in mine shafts is by means of wooden cleats. These cleats are pieces of wood from one to ten feet in length bored to fit the cable and bolted to the cross stays in the shaft. Cleats of ten feet are preferable to those of two, since the stress is more evenly distributed along the cable sheath. Both cable and cleats should be installed "inside" the cross stays where feasible, since they are then protected against mechanical damage somewhat, whereas when on the "outside" of the cross stays the cable may be damaged by traffic up or down the shaft, falling objects, etc. In any case repairs may be more convenient and safely executed. In using wooden cleats for holding the cables in place the choice of wood is important if moisture is present; oak is to be avoided, creosoted pine probably being the cheapest and most preferable, since it has long life and will not readily accelerate corrosion.

One favorite manner of stringing electrical conductors down mine shafts is to fasten them to steel or galvanized-iron messenger cable by stirrups or straps. This method is strong, is probably the best as a safeguard against electrolytic and chemical corrosion, and is the one that permits of the quickest repairs or interchange of cables. It is particularly well fitted for use with steel-armored, lead-covered cable, since the steel armor can be readily anchored to the steel messenger without fear of tearing the underlying lead sheath. The anchors should be at regular intervals, the distance depending upon the length of the shaft and the weight of the cable, but 30 to 50 feet is good practice. The messenger cable should be grounded at both ends, and for long shafts at intermediate places, the steel armor also being of course rigidly connected to the messenger. The use of similar metals in contact, for example steel upon steel, is also important in preventing corrosion and galvanic action, which is hastened in moisture-laden, acid-soaked mines. It is often very difficult to obtain good "grounds" in mines because the resistance of sandstone and similar rocks and coal is very high, hence the importance of having one continuous ground along the steel messenger cable assures the proper grounding of the cable sheath. Instead of using one messenger cable, two might be used where the installation is very important, each having sufficient tensile strength to hold the electrical conductors in place should the one fail.

Repairs to mine-shaft cables are usually difficult to make and often very costly, since making them necessitates shutting down the mine partially or in its entirety. The cost and delays due to repairs, and even the need for making them can all be largely prevented by care and forethought in making the initial installation. For high-voltage transmission down the shaft to a substation in the mine a really high factor of safety is advisable. For example, by using 6600-volt cable instead of standard 2200-volt cable for 2200-volt transmission the factor of safety is materially raised, and failures due to breakdown of insulation safeguarded against.

Some engineers prefer cambric instead of paper insulation for deep shafts, on the theory that with paper insulation the impregnating liquid has a tendency to seep down to the bottom end of the cable; the upper section may then tend to dry, and the dielectric strength to become lower, this being followed by failures, while the high pressures at the bottom may even burst the lead sheath (if unprotected by armor). In ordering cable for mine shafts it will be well to determine where joints can best be made, and order cable in the requisite lengths so that a cable splicer and his helper may find room at various depths of the shaft for their work. And remember that the reliability of a high-voltage cable joint depends to a very large degree upon the care with which it is made; good work can be done only where the worker is comfortable and safe.

When a power cable breaks down and energy is suddenly interrupted, the lights in the mine are then needed perhaps more than at any other time. Bearing this in mind suggests the wisdom of using a separate cable for supplying the lighting. In any case duplicate cables are advisable in important installations.—I. L. K. R., Chicago, Ill.

New Electrical Appliances

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

High-Voltage Induction-Type Feeder-Voltage Regulators.

By I. C. Minick.

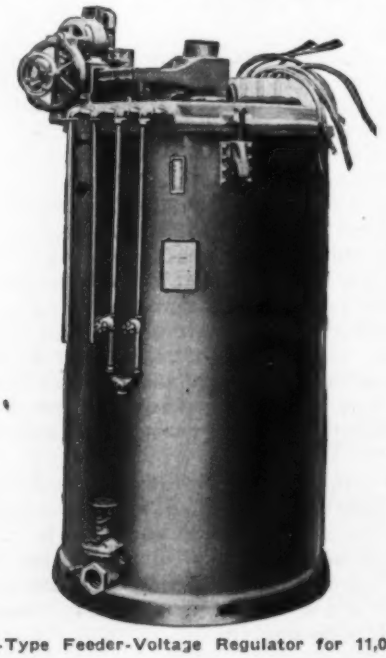
With steadily increasing loads on central stations, and the abnormally high price of copper, the problem of voltage regulation on transmission and distribution systems without incurring heavy investment has become more and more difficult of solution. The feeder-voltage regulator has accordingly received considerable attention both from the manufacturer and the central station.

Excellent results are being obtained on most large systems by the use of feeder regulators, the voltage regulation being maintained closer by the regulator than it would be by an increase in the size of the feeders and at considerably less expense.

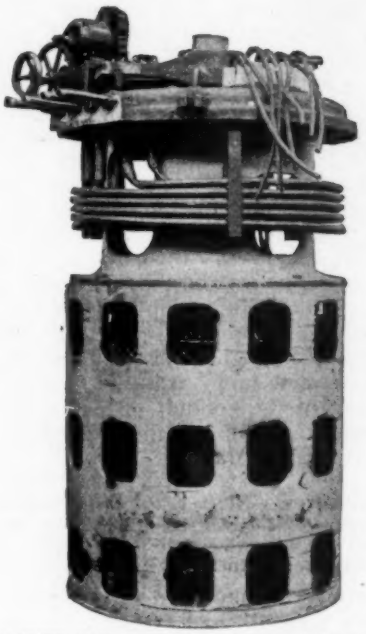
The uniformly successful results obtained by the use of the standard 2300-volt line of regulators has caused many central stations to try out feeder regulators for higher voltages on transmission lines or on distribution systems employing 11,000 volts or higher.

The accompanying illustrations show views of regulators recently furnished by the Westinghouse Electric & Manufacturing Company to the Southern California Edison Company, Los Angeles, Cal. These machines are rated as follows: 160 kilovolt-amperes, three-phase, 50 cycles, 11,000 volts for 10 per cent regulation on 1600-kilovolt-ampere, three-phase circuits and are equipped with motors and relays for full automatic operation.

These regulators have the same general mechanical designs as standard polyphase regulators for 2300 volts with especial attention being given to coil insulation in which mica is plentifully used. Also, the casing of the coil is carefully worked out and by use of steel rings around the ends, the coils are rigidly braced against magnetic shock from short circuits. When it is considered that the secondary windings are connected in series with the feeder circuit, and must therefore receive all current or voltage surges on that circuit, the requirements for high-quality insulation and extra strong bracing, properly applied, become apparent.



Induction-Type Feeder-Voltage Regulator for 11,000 Volts.



Element of 11,000-Volt Regulator Removed from Oil Tank.

As in all Westinghouse feeder regulators, these units are so constructed that the complete stator core and coils, as well as the rotor, may easily be removed from the oil tank for inspection and repairs.

As an example of the extreme care taken in the design of these regulators is cited the method of reducing vibration, with its resulting wear and noise, in case the bearings wear at one side, causing inequality in the air gap. To overcome this, the windings are built with four coils per phase, thus distributing the flux distribution more evenly.

Hayward Electrically Operated Clam-Shell Buckets.

The increasing scarcity of labor is compelling the use of labor-saving machinery wherever possible. An instance of this kind is the loading and unloading of bulk materials, which formerly was done so largely by alien or colored laborers. War conditions, however, are rapidly changing this. To meet this particular situation an electrically operated bucket has now been

placed on the market for use in connection with practically any type of crane, hoist or derrick and operated by only one man who controls both crane and bucket.

The latter is known as the Hayward electric motor

Hayward Electric Bucket Unloading Coal from Railroad Cars in Boiler Room.

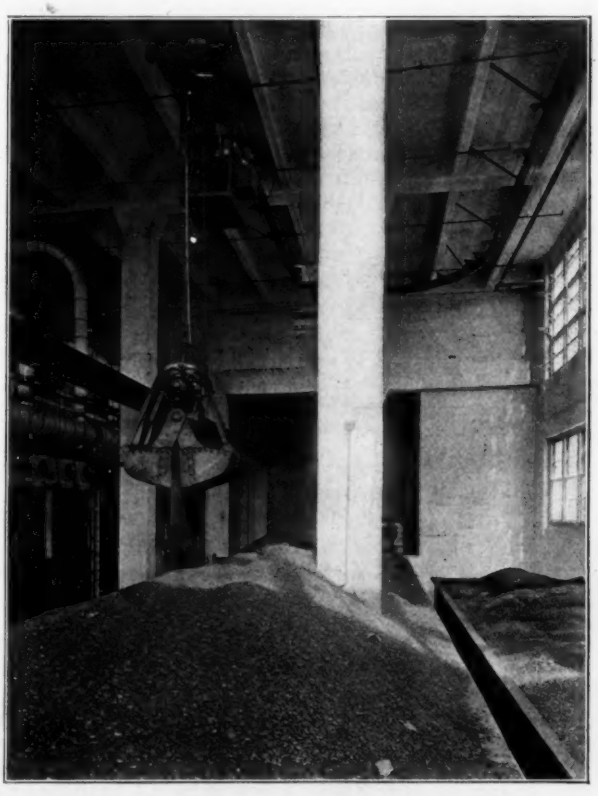
bucket. It consists of a clam-shell type of bucket of very rugged construction. It is built in capacities of three-fourths cubic yard and upward to any desired size. Attached to the suspension gear of the bucket is an electric motor with self-contained winding mechanism for closing and opening the bucket through a chain acting on its central axis. The motor is connected by a flexible cable independent of the hoisting cable or chain, in a way similar to a lifting magnet. The cable is usually provided with a terminal plug that fits a special receptacle on the side of the motor.

If a very long connecting cable is required, it is usual to provide an automatic take-up reel at one side of the bucket-supporting rods. This reel works like a window-shade roller, its rotative power being supplied by a set of compound springs inside the drum of the reel. This reel will take up cables up to 150 feet in length and prevent their dragging where they might be exposed to injury. In most cases, however, such a reel is unnecessary, because the cable can be taken care of by simple suspension from the crane.

The distinctive feature of this Hayward electric bucket is that it provides for the closing and opening of the bucket distinct from the hoisting. This means that the hoisting motor or engine is relieved of the burden of closing the bucket which when digging in hard materials requires considerable power and impedes the ordinary operation. Consequently, by operating on several parts of line, a relatively small hoisting engine is required. The bucket is operated within its own height and does not require to be dropped into the material with force so as to take a respectable bite. In fact, avoidance of such forcible dropping eliminates the hard wear and heavy repairs that buckets are usually subjected to. This means that the bucket is also especially adaptable where forcible dropping could not be tolerated. The Hayward bucket can be brought down open to the surface of the material without jar and the closing motor then energized, which causes the bucket to fill as completely as desired. A full or partial load can be picked up. In discharging, likewise, the bucket can be opened wide for sudden and complete dumping, or only partly opened for gradual discharge; moreover, if it is desired to discharge part of the load in several places, this can be done by partly opening and again closing the bucket at will. The operator has complete control of the bucket at all times.

A very simple controller is provided for bucket manipulation. Its operating handle has three positions. The middle one is dead. Throwing the handle to the left causes the motor to close the bucket. Throwing it back to center stops the motor at any time. Throwing it to the right reverses the motor and causes it to open the bucket as much as desired. If in closing the bucket its jaws should strike a hard rock or other noncrushable obstruction, this does not injure the bucket motor because the latter drives through a multiple-disk clutch that slips under these conditions and permits the motor to run. This eliminates the need for limit switches or circuit-breakers, and like other features of the outfit makes it simple and practically foolproof.

The bucket cannot discharge accidentally. Its discharge can be made gradual, as stated above, so as to deposit its load near to workmen without danger, or in places where a sudden dump would impose a severe strain on the floors or sides of wagons, cars, bins, hoppers and the like.



Electric Bucket Delivering the Coal to Bunkers in Front of the Boilers.

These buckets are suitable for a variety of purposes, such as for coal and ash handling in boiler rooms; sand moving in foundries; ore handling, slag removal and other uses in iron and steel mills; for handling bulk materials in industrial plants; coal, sand and gravel loading and unloading on railroads, docks and terminals; sand and earth excavation in general construction work, etc. The bucket can be readily taken off the hook of the crane or derrick and the latter used for general hoisting when desired.

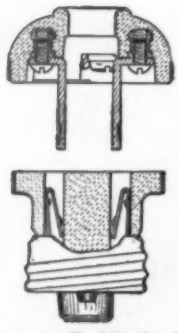
Two accompanying views show use of the Hayward electric bucket in unloading coal from a railroad car to the bunkers in front of the boilers. These views are in the boiler room of the Loose-Wiles Biscuit Company, Long Island City, N. Y. An electric monorail hoist is used. Such use is especially suitable where bottom-dump coal cars are not used or where there is no pit into which such cars might discharge. In such cases hand shoveling has usually been resorted to, but is now practically out of the question. It will be noted that the bucket can empty a car thoroughly and quickly and dump its load without raising an annoying dense cloud of dust each time or spilling its contents all along its travel.

The Hayward electric motor buckets are manufactured by the Hayward Company, 50 Church Street, New York City.

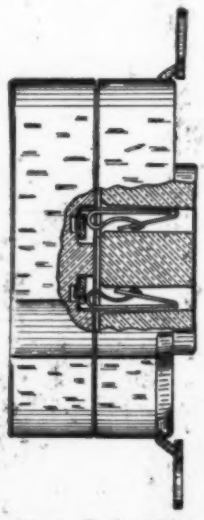
Standard Arrow Plugs and Receptacles.

The Arrow Electric Company, Hartford, Conn., is manufacturing a complete and interchangeable line of "Standard" plugs and receptacles. The attachment plug is separable. The plug body is threaded for Edison base outlets and the plug caps act as an adapter for thirteen different body parts.

There are four different flush receptacles, five different surface receptacles, two current taps and two adapters, making a complete line of fittings for any form of installation.



Arrow E Standard Separable Plug.



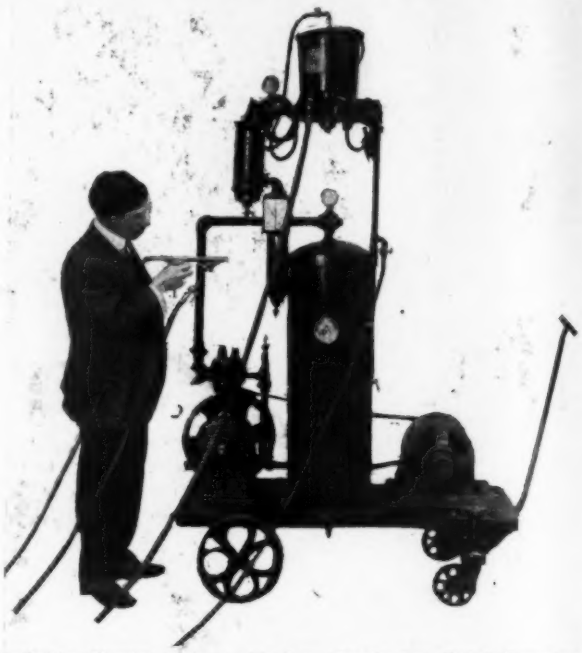
Arrow E Standard Receptacle.

All the springs in Arrow E "Standard" plugs and receptacles are re-inforced, as shown in the accompanying illustrations. This insures a perfect contact, no matter how often the plug is inserted or withdrawn.

The "Standard" line is properly named. Six prominent attachment-plug manufacturers are making it. It can be universally adopted by all branches of the trade to advantage, as it will give an interchangeable and uniform method of attaching appliances.

Electrically Operated Air-Gun Outfit for Paint Spraying.

Herewith is given an illustration of a motor-operated air-gun outfit for paint spraying, designed and manufactured by David A. Wright, 568 W. Washington Boulevard, Chicago. The outfit is portable, and is well adapted to the work of applying paint to buildings, ships and other surfaces. It can be as readily used for varnishing and kalsomining. The equipment utilized is clearly shown in the accompanying picture. This consists of a one-horsepower motor, belt-connected to an air-compressor, by which pressures of 50 to 70 pounds for heavy material and 30 to 60 pounds for lighter material are exerted in operating the air gun. The relative positions of the air receiver, water and oil separators, air regulator and container will be noted. As the paint or other material is applied warm, an electric heater is placed just below the container. The container is equipped for the air-agitation of any material that may have a tendency to settle and make a non-uniform consistency. The material is also strained before it enters the container, to keep out lumps that might clog the tubes or hose through which it is forced to the nozzle or air-gun outlet. It will be observed that the paint hose is joined in the nozzle section by an air-pressure hose. The compressed air mixing there with the fluid paint causes a complete atomization of the latter as it is sprayed against the surface being painted.



Portable Electric-Driven Air-Gun Outfit for Paint Spraying.

The outfit is made for four different sizes of nozzle by which the volume of material is gauged. A number of these have been ordered by the Bethlehem Steel Corporation for use in painting ships, and by Allis-Chalmers Company in its shops. This kind of an outfit is especially advantageous as a means of saving labor costs and of facilitating work in these times of labor scarcity.

Miniature Meters for Commercial Circuits.

To meet the demand for miniature instruments, the General Electric Company, Schenectady, N. Y., has perfected round voltmeters and ammeters 2¼

inches in diameter which give very accurate readings on direct-current circuits ranging from 10 to 150 volts and 10 to 150 amperes, respectively.

These instruments, called the type DM, utilize the D'Arsonval permanent-magnet moving-coil principle. The voltmeters have self-contained resistance and the ammeters have self-contained shunts up to 40 amperes. Extremely light-weight moving elements are used with

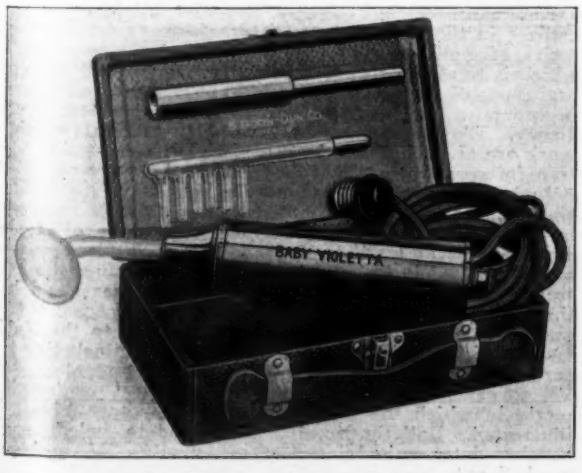
Miniature Voltmeter and Ammeter for Direct-Current Circuits.

hardened polished points and jeweled bearings. The practice followed in the General Electric meters made for heavier service is followed closely. The zero adjustment is made by a small screw in front at the base of the instrument so that it is not necessary to open the case except at rare intervals.

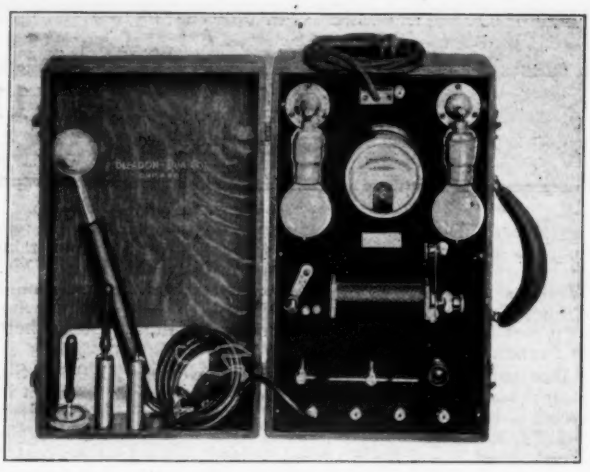
In order to obtain complete and permanent insulation all parts of the measuring elements are mounted on a Bakelite base. The scale and mechanism are protected from foreign substances by a drawn brass cover carrying a round glass dial. For convenience in reading, a metal scale plate is used with black background.

New Violet-Ray and Other Electrotherapeutic Apparatus.

The beneficial effects of electrotherapeutic treatment are coming to be so generally recognized that a large demand has arisen for simple and reliable equipment by which it may be applied by the ordinary layman. Especially is this true with high-frequency violet-ray apparatus, which gives an invigorating and perfectly safe as well as pleasant treatment found very satisfactory by physicians, chiropractors and beauty experts for many ailments and for toning the tissues and nervous system. An apparatus for this purpose that has met with great favor is the Violetta, which in compact form produces an easily regulated high-frequency violet-ray discharge of great penetrating power. This equipment was described in our issue of March 4, 1916. It consists of a violet-ray generator



New Baby Violetta High-Frequency Outfit.



Combination Electrotherapeutic Cabinet and Wall Plate.

with self-contained Tesla coil, regulator and electrode.

The popularity of this set has induced its manufacturer, the Bleadon-Dun Company, 11-17 South Desplaines Street, Chicago, to put on the market a smaller and less expensive form of the apparatus, which has been called the Baby Violetta. It is expected to retail for $15, which places it within the reach of nearly everyone. As shown in the accompanying view, the new set has the generator, glass electrode and connecting cord all in one, and is furnished with a handsome case. It can be attached to any 110-volt lighting circuit and takes only a very small current. It operates exactly on the same plan as the larger Violetta outfit, but takes a little longer to give an equivalent treatment.

The company has also a combination cabinet and wall plate for physicians' use. It is shown in the second illustration and, as can be seen, provides in one compact set for the four treatments commonly used in electrotherapeutics, namely, galvanic, faradic, high-frequency and sinusoidal currents. It includes a cord for connecting to the ordinary lighting circuit, an adjustable induction coil, a rheostat, a Tesla coil, a milammeter, two lamps for illumination and resistance, a spark gap, special electrodes or applicators, connecting cord, terminals, etc. Ease of adjustment is provided for in every detail. Means are also arranged for connecting and regulating diagnostic lamps.

This outfit is mounted in a portable and handsome oak case, measuring only 16 by 10 by 7½ inches. It can be carried like a suitcase, or quickly mounted on the wall.

Keyless Receptacle for Conduit-Box and Sign Work.

The demand for a mogul-base porcelain receptacle for conduit-box and large sign work is met by the General Electric Company, Schenectady, N. Y., with a new receptacle having a rating of 1500 watts, 250 volts. This receptacle takes a 2 3/16-inch hole in the sign front, and the socket is adapted for mogul-base lamps.

Mogul-Base Keyless Porcelain Receptacle.

Activities in the Trade

Bryant Electric Company, Bridgeport, Conn., announces the appointment of George E. Williams to take charge of its New York office, at 51 East 42d Street. Mr. Williams formerly was New York representative of Gillinder & Sons Company. He takes the place of Robert Abbott, who, as a member of the Roosevelt Hospital Unit, is "Somewhere in France."

Benjamin Electric Manufacturing Company, 120-128 So. Sangamon Street, Chicago, presents many new features in panel-board construction in the current Benjamin catalog S-2. A line of residence panels, with innovations in dead-front panel board design are featured. It marks a greater advance during the last year than in all previous periods of panel-board construction. What is also impressive about this bulletin is the clearness of the specifications, directness of description, and the page headings that indicate the purpose of the listings.

National Electric Utilities Corporation, 103 Park Avenue, New York City, has received an order from Panama Canal authorities for all ranges, broilers and accessories for installation in the new Ancon Hospital at Panama. The award was made after severe competitive tests made by the Canal authorities, and is considered a special recognition of the corporation's Neuco electric cooking apparatus, from an electrical and a mechanical standpoint. It is claimed this will constitute one of the largest electric kitchens in this or any other country.

Hubbard & Company, Pittsburgh, Pa., have issued a supplementary Bulletin No. 1, pertaining to their electrical material department. Special attention is given to the Pierce presteel racks for overhead line construction. This type of rack is designed to carry No. 3 and lighter wire secondary mains on poles and for service wires on buildings. Presteel racks for No. 3 wire are illustrated, as are also the Pierce standard racks for any sized wire, showing by comparison the lighter form of the presteel rack. The latter is specially advantageous for carrying secondary mains on poles, instead of on wood cross arms. This bulletin also contains illustrations and descriptions of the Pierce heavy presteel spreaders and break arms; the light presteel, horizontal house brackets, pole top brackets and other features that cannot fail to interest the electrical construction engineer.

The Sangamo Electric Company announces the opening of a Chicago district office in the Old Colony Building, in charge of C. H. Hurtt as district manager. For several years the Sangamo company has had a Chicago representative, located with the Electric Appliance Company, for many years selling agents for the Sangamo Electric Company throughout the middle west. In establishing this new office, the Sangamo company has made no change in the selling arrangements with the Electric Appliance Company and the Federal Sign System (Electric) of Chicago, who will continue to handle Sangamo products exactly as in the past. The new office has been established with a view to giving a more complete service on Sangamo meters and other products than has heretofore been possible in Chicago and surrounding territory; this being necessary on account of the greatly increased demand for Sangamo products. A completely-equipped repair department will be maintained as heretofore, under the management of the Chicago office.

The Under-feed Stoker Company of America, manufacturer of the Jones underfeed mechanical stoker, gives some interesting stoker data in its publicity magazine. The municipal water and lighting plant, at Waterloo, Wis., is illustrated and described. The two 72 by 18 return tubular boilers were equipped with Jones stokers in May, 1915, the main object in view being to accomplish smoke abatement. The result not only was a successful elimination of the smoke that previously settled over the village, but there was a saving of 15 to 18 per cent. in coal consumption. The plant load has been about doubled by the use of additional motors and on account of adopting an all-night service; and exhaust heat is utilized for heating business blocks. The Under-feed Stoker Company's general office is in Harris Trust Building, Chicago.

Trumbull Electric Manufacturing Company, Plainville, Conn., has under construction an additional plant building, to make room for increasing production of electrical supplies. The new building is to be completed and in use before the close of the year.

Habirshaw Insulated Wire, manufactured by the Habirshaw Electric Cable Company, and sold and distributed by Western Electric Company, is a product backed by Habirshaw reputation and Western Electric service. The Western Electric Company has sent out advance copies of advertising appearing in Saturday Evening Post. This advertising boosts the electric idea generally, and sets forth the claims and merits of the electrical contractor as the man who should do the wiring; this proper appeal closes with a few clinching statements concerning the insulated wire behind the push button and socket, and then the attention of the reader is focused upon Habirshaw insulated wire, accepted as standard.

Edison Storage Battery Company, Orange, N. J., presents useful storage-battery information in its new Bulletin 610. The pictures, of themselves, tell an interesting story of the uses of storage-battery trucks and industrial locomotives, in the lumber industry, for haulage at sawmills, between docks and yards and to shipping points. One striking picture is that of a train of 9 cars, loaded with 22,631 feet of lumber, drawn on tracks by a 6-ton storage-battery industrial locomotive. The use of the storage-battery tractor is shown in the pulling of the lumber dolly and wagon over dock floors and roadways. In this bulletin a description of the Edison alkaline storage battery is accompanied by a cut of this battery, giving a cutaway view showing interior parts. Other illustrations are given, also tables of data useful to the electrician.

Electric Storage Battery Company, Philadelphia, in its Bulletin No. 165, discusses the things essential to the success of the small central station. One of these is the ability to assure reliable service 24 hours per day throughout the year. As an economic aid in keeping costs below the prohibitive figure, this company offers its storage battery of Chloride Accumulators, to be charged from the generating unit while running to carry the evening load; and during the hours of minimum load the engine may be shut down, while the battery supplies the power without attendance. The result is that the day load becomes the least expensive. It is said these good results have been attained at numerous small central stations by use of this type of battery. In one case there was installed a storage battery of 62 cells of Chloride Accumulator, type E-9, rated at 20 amperes for 8 hours, and 8 E-9 counter-electromotive-force cells for voltage control, to establish a 24-hour service. The bulletin is of special interest, as it contains not only descriptions, but illustrations showing the load curve at various small stations.

Kuhlman Electric Company, Bay City, Mich., which specializes in the manufacture of transformers, has issued a series of Bulletins, 101 to 107 inclusive, the province of which is to afford special information concerning the several types of transformers made by it. The improvements in apparatus are put forth only after practical test of efficiency. Illustrations of the several departments of shop work are given in Bulletin 101. Single-phase station type transformers are carefully described and illustrated in 102. All advantageous features are referred to. In No. 103 the single-phase pole type for distribution lines is presented in attractive fashion, accompanied by a table of dimensions and weights. The 3-phase equipment is discussed and illustrated in Bulletin No. 104. The Kuhlman 3-phase transformer has been on the market 15 years, and has three distinct magnetic circuits in its core of equal length and reluctance. Next is No. 105, pertaining to the Kuhlman Service multiple street lighting systems, including the series multiple transformer for mounting on poles. No. 106 covers special equipment and electrical engineering work, in which the high-voltage outdoor transformer is illustrated. Bulletin No. 107 is devoted to strictly engineering data, embodying a great number of problems worked out.

Men in Government Service

Items of Interest Concerning Power and Electrical Men Who Have Joined the Colors

BERT R. JONES, electrical engineer in the U. S. Army, has been transferred from Fort Snelling, Minn., to Fort Sill, Okla.

LAWRENCE B. WEBSTER has been commissioned as captain in the ordnance department of the United States Army. He is secretary of the Western Ohio Railway, with headquarters in Cleveland.

CHARLES A. LUNN, manager of Pine Products division for Ralph L. Fuller & Company, 2 Rector Street, New York City, entered military service September 15, in the Ordnance Department of the National Army, in a technical capacity. Mr. Lunn was married on August 29.

WILLIAM F. EASTMAN has resigned as general manager of the Technical Journal Company, publisher of Electrical ENGINEERING, New York City, to enter the Reserve Officers' Training Camp, Plattsburg, N. Y. He has been assigned to the Artillery division, and expects to qualify as a first lieutenant.

R. W. SPOFFORD, general manager of the Augusta-Aiken Railway & Electric Corporation, Augusta, Ga., has been appointed to a position in the United States naval service and is now only devoting a part of his time to railway management. Lewis Keim, purchasing agent of the company, will look after his railway interests.

THE SOCIETY FOR ELECTRICAL DEVELOPMENT has three of its employees in Government service. Hill Griffith, until recently with the advertising department, has been made captain of Cavalry at Fort Meade, Md. R. R. Jones is now first lieutenant in the Signal Service. J. J. Flynn, another member of the staff, is with the National Army at Camp Upton, Long Island, N. Y.

H. A. FIFE, engineering department of the Commonwealth Edison Company, Chicago, has been commissioned a captain in the Eleventh Illinois Infantry and is now at camp at Springfield, Ill. This company is composed entirely of Commonwealth Edison employees. W. R. White is first lieutenant and H. G. Kobick is second lieutenant. Captain Fife was previously a first lieutenant in the First Illinois Infantry, and resigned before the outbreak of the war.

ELBERT F. NORTON, sales engineer with the Standard Underground Cable Company, with headquarters at the Chicago office, has received a commission as major in the Engineers' Reserve Corps, U. S. Army, and has left for three months' training at Ft. Leavenworth, Kans. Mr. Norton is a graduate of Purdue University in electrical engineering, and is well known in the electrical field. He has been with the Standard Company about five years and previous to this employment was an erecting engineer of electric and steam power plants.

L. W. HENRY, Indianapolis, Ind., is now superintendent of the Indianapolis & Cincinnati Traction Company, succeeding Charles O. Warfel, who resigned to take a commission as captain in the army.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW will *welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

MONTGOMERY COMPANY BUILDS SOLDIERS' CLUB.—Following out the plan which he had already announced, H. D. Frueauff, general manager of the Montgomery (Ala.) Light & Water Power Company, has opened club rooms in the company's building in that city for the benefit of the Ohio troops which are training at the local cantonment. The club room which was opened on September 6 is on the second floor of the building, which is situated opposite the post office in a part of the town easily accessible to the soldiers. In describing the opening of the club room the Montgomery *Advertiser* said that "the large crowd which attended felt itself, individually and collectively, right at home." The idea of the club was prompted by the fact that many Doherty employees from Ohio have joined the colors.

JAMES ROBB, a vice-president of the American Telephone & Telegraph Company, is known in other circles as Major Robb of the Depot Battalion of the 23rd Regiment of Brooklyn. For thirteen years Mr. Robb's military career led him from the grade of private to the rank of captain in the Twenty-third, until in 1913 temporary ill health made it necessary for him to give up his military activities. On July 20 of this year, however, Mr. Robb gained his rank of Major when Brigadier-General Stotesbury, Adjutant General of New York State, notified Colonel Norton that Governor Whitman had appointed "former Captain James Robb of Company C" to command the Depot Battalion of the Twenty-third.

FRANK G. BOLLES, formerly of the International Trade Press, Inc., and more recently vice-president of the Russia-American Trading Corporation, New York, has been appointed Major in the Ordnance Department of the United States Army. Mr. Bolles has for many years past been connected with large electrical and manufacturing interests, including the Westinghouse Companies, Bullock Electric Company, Allis-Chalmers Manufacturing Company, the Bucyrus Company and others, and was also engaged prior to the war in extensive research work abroad for the Department of Commerce. He has also, at various times, undertaken special work for the ELECTRICAL REVIEW and is one of its valued contributors.

MILITARY ACTIVITY IN UNIVERSITY OF WISCONSIN.—University of Wisconsin enters the academic year 1917-18 with a clearly outlined program for training students to meet conditions both during and following the war. It is expected the great majority of students will return to go through with their college courses. Many members of the faculty are in army uniform, some of them being away on Government work. Throughout, the university ideal will be to emphasize its full duty in the war crisis.

An Infantry unit of the senior division, Officers' Reserve Training Corp, will be established this Fall, in accordance with a request made by the Board of Regents to the War Department. Preparations are being made to put this in effect. The purpose of this is to have reserve officers in training for forces being raised for national defense. After graduation the student thus trained may accept commissions in the Officers' Reserve Corps.

UNDERWRITERS' LABORATORIES, INC., Chicago, Ill., announces that the following former employees are in uniform: First Lieutenant H. H. Allport, Heavy Artillery, assigned for duty in France, formerly assistant engineer Protection department, Chicago office; Captain R. M. Clucas, Frankford Arsenal, Bridesburg, Pa., formerly assistant superintendent Label Service, Chicago office; First Lieutenant W. E. Lucas, official interpreter on General Pershing's staff, American Army headquarters, France, formerly assistant engineer Sprinkler Division, Protection department, Chicago office; Sergeant-Electrician J. E. Ruggles, National Guard Coast Artillery, Fort Hamilton, N. Y., formerly Inspector, New York office; Major W. G. Tobin, Texas National Guard, formerly agent, San Antonio office, and C. P. Hawes, E. L. Ihrig, R. A. Newton, F. F. Palmison, O. L. Robinson, C. W. Rulon, J. Sheldon, W. T. Wagner, M. B. Wallbank, R. M. Bernico, E. T. Bjorstrom, W. W. Dean, E. A. Jaggle, J. H. McLaughlin, C. J. Peacock, F. C. Petersen and A. N. Rohr.

Personal and Biographical

HARRY HOLLIS is now electrical engineer for the Bethlehem Steel Company, Lebanon, Pa., having resigned a like position with the Reading Transit Company, Reading, Pa.

JOHN P. KELLY, Trenton, N. J., has been re-elected president of the Trenton Electric Club for the coming year. Arthur Bennett is vice-president, and Harry Williams, treasurer.

E. W. KEARNS, who has been manager of the Light & Power Company at Rainier, Ore., for the last six years, has assumed charge of the plants at Newport and Toledo, Ore. G. E. Ringle, formerly of Hillsboro, has succeeded him at Rainier.

CHARLES POETHKE, who has held the position of chief smoke inspector of Milwaukee since 1904, has been reappointed for another term of four years. He is a charter member of the International Association of Smoke Prevention.

WILLIAM H. FETNER, general master mechanic of Central of Georgia Railway, has been appointed acting superintendent of motive power. He succeeds Frederick F. Gaines, who has been granted a leave of absence on account of illness.

T. F. GROVER is now vice president and general manager of the Chicago, South Bend & Northern Indiana Railway, South Bend, Ind. He went to South Bend from Terre Haute, where he was connected with the Terre Haute, Indianapolis & Eastern Traction Company.

E. E. POTTS, Lexington, Ky., has been appointed purchasing agent of the Kentucky Traction & Terminal Company, the Lexington Utilities Company and the Lexington Ice Company. He formerly was general storekeeper for the Kentucky Traction & Terminal Company.

W. J. GRAMBS, of Seattle, Wash., assistant to the president of the Puget Sound Traction, Light & Power Company, has been appointed section chief of the Sixth District of the Free Navigation Schools, by the United States Shipping Board. The schools are established by the Government and under the Board's general supervision and Mr. Grambs has supervision over the schools of Astoria, Portland and Tacoma.

J. D. WHITTEMORE has been appointed general manager of the West Virginia Traction & Electric Company, Wheeling, W. Va. He formerly was general manager of the Claremont Railway & Lighting Company, Claremont, N. H., and these roads are both controlled by the Eastern Power & Light Corporation, New York. Mr. Whittemore has been connected with the General Electric Company, both at Boston and Schenectady; also with the Rochester Railway & Light Company at Rochester, N. Y. Before joining forces with the Claremont Railway & Lighting Company he was manager of the Gardner Electric Light Company at Gardner, Mass.

FRED J. MOORE, who has been connected with the Ohio Electric Railway, headquarters at Springfield, since its inception, is now general superintendent of transportation for the railway. For a number of years he was superintendent of the three divisions entering Columbus.

O. H. SIMONDS, general manager and purchasing agent of the Vicksburg Light & Traction Company, Vicksburg, Miss., has been appointed general manager of the Dubuque Electric Company, Dubuque, Iowa, succeeding E. M. Walker, who recently resigned. Elston & Company, Chicago, control the Dubuque and Vicksburg properties.

STANLEY CLAGUE, who has been active in the Advertising Association of Chicago for a number of years, recently was unanimously elected managing director of the Audit Bureau of Circulations, by the board of directors of that organization. Mr. Clague has been a director of the Audit Bureau of Circulations since it was founded. In accepting the managership of the Audit Bureau he withdrew from the advertising firm of Taylor-Critchfield-Clague Company. The province of the A. B. C. is to compile and furnish data relative to the circulation of publications, based upon direct examinations of subscription lists. Mr. Clague is a member of the International Commission of Associated Advertising Clubs of the World. The headquarters of the Audit Bureau are at 15 East Washington Street, Chicago.

LAWRENCE E. GOULD has organized the Economy Electric Devices Company, which company will act as exclusive sales agent for the railway products of the Sangamo Electric Company, Chicago. Mr. Gould, who has been connected with the *Electric Railway Journal* for many years, is well and favorably known in the electric railway industry and has been active in many territorial electric railway associations, as well as other associations. He was born in Michigan and received his electrical engineering education at Cornell University. When a boy in school he worked for the Owosso & Corunna Electric Railway & Light Company, now part of the Michigan Railway system. He rapidly advanced, having held various responsible positions and in 1905 was appointed electrical editor of the *Electric Railway Journal* and before the year was over was made editor-in-chief of that paper. In 1908, when that paper and the *Street Railway Journal* became known as the *Electric Railway Journal*, Mr. Gould was appointed western editor, which position he held until 1912, when he went to New York to become business manager for the paper. In 1914 he returned to Chicago as western manager and in May, 1916, was appointed industrial editor in charge of the department which he created, known as "Manufactures and Markets." He continued in this capacity until his present venture.

FRELING FOSTER, until recently advertising manager, Hughes Electric Heating Company, Chicago, has joined the advertising staff of the Society for Electrical Development, with headquarters in New York. He will take the place made vacant by the resignation of E. M. Hunt, who has become connected with the *Review of Reviews*.

Obituary.

FRANK L. DEERING, claim agent for the Edison Electric Illuminating Company, Brooklyn, N. Y., died at the Bushwick Hospital in that city on September 7, aged 60 years.

EDWARD J. JOHNSON, New York, an inventor, for many years associated in an important capacity with Thomas A. Edison, died at his home on Park Avenue, September 9, aged 71 years.

ETNA KUHLMAN, president of the Kuhlman Electric Company, Bay City, Mich., died on September 14 at his home, after a lingering illness. Mr. Kuhlman was one of the pioneers in the transformer industry and did much towards raising the standards of practice. He was widely known in electrical circles and his untimely death will be a distinct loss to the industry.

ROBERT K. YOUNG, Wellsboro, Pa., a member of the state Public Service Commission, died at the Blossburg Hospital of that city, September 12, as a result of an injury to his leg. Mr. Young was also president of the Wellsboro Electric Company and of the Tioga County Savings & Trust Company. He was formerly State Treasurer, being elected to office in 1913, and upon expiration of term in May, 1917, appointed a member of the Public Service Commission.

FRANCIS B. H. PAINE, New York, a member of the firm Paine, McClellan & Campion, electrical and consulting engineers, died at his home on Riverside Drive, September 13, aged 48 years. Mr. Paine was born in Chicago and gained his electrical and engineering education with the Westinghouse Electric & Manufacturing Company. He was connected with the power development work of the Ontario Electric Light & Power Company at Niagara Falls. He is survived by his widow, a son and a daughter.

THOMAS EWING, after having served four years as Commissioner of Patents, Washington, D. C., has resigned that position to resume the practice of law, with offices at 160 Broadway, New York City. Inasmuch as he was engaged in law practice in that city for many years prior to assuming the duties of Commissioner of Patents, his resumption of activities in that profession will be accomplished promptly. Mr. Ewing was assistant examiner of patents from 1888 to 1890, and his subsequent law practice was largely in connection with patent causes, during which he handled many of the most important matters before that department.

Current Electrical News

WEEKLY RECORD OF CONSTRUCTION ACTIVITIES

EASTERN STATES.

RUTLAND, VT.—The Rutland Railway, Light & Power Company is building a new transmission line from its Rutland substation to West Rutland. A high tension line from West Rutland to Castleton Corners has recently been completed.

SPRINGFIELD, VT.—Jones & Lamson Machine Company, manufacture of lathes, has awarded a contract for the erection of a new one-story addition to its power plant, about 30x60 feet, for works operation.

NEW BEDFORD, Mass.—New Bedford Gas & Edison Light Company has commenced the erection of an addition to its power plant on Cannon street to cost about $500,000. Stone & Webster, Boston, are engineers for the company.

NEW LONDON, CONN.—Bureau of Yards and Docks, Washington, D. C., has completed plans for the construction of a new power plant at the local naval station to cost about $500,000. F. R. Harris, chief.

BUFFALO, N. Y. — Buffalo General Electric Company has commenced the construction of an addition to its power plant station on the River Road.

NEW YORK, N. Y. — Interborough Rapid Transit Company has acquired property on East Eighteenth street, adjoining its power plant, for the erection of an addition. The company is also planning for the construction of a new transformer station on West Sixteenth street.

NEW YORK, N. Y.—New York Edison Company is building a one-story addition to its substation on West Twenty-seventh street. The structure will be about 25x46 feet, and cost $35,000.

NEW YORK, N. Y.—Bronx International Exposition, Inc., has arranged for the construction of a new transformer department at its building on One Hundred and Seventy-seventh street.

NEW YORK, N. Y.—King County Light & Power asks for authority to issue additional bonds amounting to $1,000,000, the proceeds of which to reimburse the treasury for improvements made.

THIELLS, N. Y.—Board of Managers of Letchworth Village will receive bids until September 28 for electrical work in the Assembly Hall and Industrial Building. Frank A. Vanderlip, 7 Wall street, New York City, is president.

WHITE PLAINS, N. Y.—Westchester Street Railway Company has had plans prepared for a new two-story operating plant on Main street.

BAYONNE, N. J.—Public Service Electric Company is arranging for the immediate installation of a new street-lighting system on lower Broadway from Fifth to Tenth streets. A new system will also be installed on the same thoroughfare from Tenth to Eighteenth streets.

BAYONNE, N. J.—Board of City Commissioners has had plans prepared for the installation of an electric-lighting system in the Park House, City Park, West Fifteenth street. Bids for the work are now being asked.

DOVER, N. J.—New Jersey Power & Light Company has completed arrangements for purchasing power from the Jersey Corporation. The latter company will immediately install a new 200-kilowatt generator at its plant, to be driven by water turbine.

ESSEX FELLS, N. J.—Public Service Electric Company has made contract with Essex Fells Borough Council for lighting the Borough for a term of five years. Rates will be the same as with other surburban municipalities for similar service.

GLOUCESTER CITY, N. J. — City Council has passed an ordinance granting a 50-year franchise to the Delaware & Atlantic Telegraph & Telephone Company for the installation of underground and aerial lines in different sections of the city.

NEW BRUNSWICK, N. J. — Public Service Corporation has completed the erection of a new engine and compressor house addition to its local plant.

NEWTON, N. J.—Newton Electric & Gas Company will draw up and submit a proposition in reference to lighting the streets here.

PERTH AMBOY, N. J.—C. Pardee Works, manufacturers of steel billets and bars, are considering the installation of a new gas producer plant to replace the works recently destroyed by fire.

CHALFONT, PA.—Borough officials are planning for the installation of a new electric-lighting system. A power line will be constructed from Lansdale to Chalfont to furnish service.

ENOLA, PA.—Pennsylvania Railroad Company has commenced the installation of a new lighting system at its local shops, replacing arc lamps with 600-candlepower units. The new system will include both shops and yard.

ERIE, PA.—Union Iron Works will build a new power plant at its works on Cascade street. The structure will be one-story, about 60x90 feet, and cost $15,000.

HARRISBURG, PA.—Bell Telephone Company of Pennsylvania has completed the construction of a new line between Harrisburg and York.

KULPSVILLE, PA.—Borough Council is installing a new electric system for street-lighting service.

PHILADELPHIA, PA. — Bureau of Yards and Docks, Washington, D. C., is preparing plans for the erection of a new power plant at the local navy yards to cost about $45,000. F. R. Harris, chief.

PHILADELPHIA, PA.—De Long Hook & Eye Company is building a one-story power plant at its new factory at Twenty-first and Clearfield streets. The entire plant will cost about $250,000.

PHILADELPHIA, PA.—Girard Point Storage Company has awarded a contract for the construction of a new one-story power plant, 34x45 feet, at Twenty-sixth street and Forty-fifth avenue, to cost about $31,000. John N. Gill & Company, Otis Building, are the contractors.

PHILADELPHIA, PA. — Henry H. Sheip Manufacturing Company, Sixth street and Columbia avenue, is taking bids for the construction of an addition to the power plant at its woodworking factory.

PHILADELPHIA, PA.—Niles-Bement-Pond Company, manufacturer of machine tools, is having plans prepared for the construction of a new one-story, reinforced-concrete power plant, 90x108 feet, at its Plainfield, N. J., works. Harris & Richards, Drexel Building, are architects. Headquarters of the company are at 111 Broadway, New York City.

PHILADELPHIA, PA.—Standard Construction Company, Drexel Building, has submitted a low bid to the city for the construction of a new power plant at the Philadelphia General Hospital, Thirty-fourth and Pine streets, at a cost of $226,800, and with proposed additions in initial plans, $238,600.

PHILADELPHIA, PA. — Treen Box Company has awarded a contract for the erection of a one-story power plant, 30x60 feet, at its new factory to be located at Memphis and Tioga streets.

PITTSBURGH, PA.—Pittsburgh, Mars & Butler Railway Company will expend $1,250,000 in improvements. Address R. H. Boggs, president of the Dollar Trust & Savings Company.

PITTSBURGH, PA. — Public Service Commission has granted the Duquesne Light Company permission to issue securities for $3,271,250 for extensions and improvements, and existing obligations.

READING, PA.—Metropolitan Electric Company, Reading; the Edison Electric Company, Lebanon; the Lebanon Valley Electric Company, Lebanon, and the Lebanon Valley Electric Light Company, Lebanon, have been merged into one company to be known as the Metropolitan Edison Company. The new organization has acquired the control of the Pennsylvania Utilities Company and will in turn be under the ownership of the Eastern Power & Light Company. The companies affected are operated by W. S. Barstow & Company, and Bonbright & Company, Inc., New York. The new organization will operate the proposed new power plant of the Metropolitan Electric Company on the Schuylkill River, near Klapperthal, construction of which has been commenced. The plant will be two stories, reinforced-concrete, with initial installation to comprise two turbo-generators. It will be used to augment the present power service in the Lebanon Valley district, and is estimated to cost $100,000. The company is also building an addition to its West Reading plant, about 25x60 feet, to increase the present capacity. The work will include considerable expansion and improvement in the boiler works, consisting of new automatic coal-handling equipment and other apparatus to cost about $125,000. A new rotary substation and switching station will be erected at Sixth and Bern streets, Reading, to cost about $10,000.

Business is Good

Business conditions at this time are most satisfactory. There seems to be very little let up. In a general way business in the next year is going to be very prosperous.—L. L. Brastow, Sales Manager, Trumbull Electric Manufacturing Company.

WORMLEYSBURG, PA.—Valleys Railway Company has acquired property in the Church-Keller section, and is reported to be planning for the erection of a new power plant and car works.

BALTIMORE, MD.—Consoudated Gas, Electric Light & Power Company is having preliminary plans prepared for the proposed addition to its power plant at Westport. The company is also planning for line extensions to serve the industrial districts at Sparrows Point, Canton and other sections. Arrangements are being perfected to expend about $5,510,000 on the proposed extensions and betterments.

FARMVILLE, VA.—Town officials have awarded a contract for the erection of a two-story addition to the local power station to cost about $20,000. T. C. Boggs is chief clerk.

RICHMOND, VA.—Chesapeake & Ohio Railroad is planning for the erection of a new power house at its works at Raleigh, W. Va. F. I. Cabell is chief engineer.

ROANOKE, VA.—Roanoke Railway & Electric Company is planning for the installation of two new turbo-generators at its power plant, with capacity of 5,000 and 4,000 kilowatts, respectively.

RICH SQUARE, N. C.—Rich Square Light & Power Company will improve electric lighting plant, installing crude oil engine, purchase new equipment, etc.

SPARTANSBURG, S. C.—South Carolina Light, Power & Railways Company is considering building an extension to Camp Wadsworth.

CLARKESVILLE, GA.—Wofford Shoals Light & Power Company has contract to furnish town with light and power. The company has leased equipment of the Georgia Railway & Power Company and will erect a line from Clarkesville to the transmission line to Habersham Mills.

ST. PETERSBURG, FLA.—Contract probably will be let soon for the construction of the Petersburg-Tampa Electric Railway Company's 18-mile line. The project involves the construction of a bridge across old Tampa Bay at an estimated cost of $1,000,000. Address Geo. S. Gandy, care Wayne Trust Company, Philadelphia.

VERO, FLA.—Brevard Telephone Company, of Fort Pierce, will build a telephone exchange and office structure. G. W. Smith, manager.

NORTH CENTRAL STATES.

ELYRIA, O.—Elyria Telephone Company has increased its capital from $200,000 to $350,000.

YOUNGSTOWN, O.—Youngstown & Suburban Railway Company is planning extensive improvements to its line connecting Youngstown and Leetonia, as well as building a branch from Columbiana to East Palestine. The company is about to erect its own power plant at the southern extremity of its line and new substations along the line. The erection of a power plant will necessitate enlargements of substation at car barns and other changes and improvements.

FORT WAYNE, IND.—Henry L. Doherty & Company, New York City, are planning an electric road from Fort Wayne to Toledo. The route is scheduled to touch points not reached by the present line, such as Defiance, Grand Rapids, Waterville and other points.

BLOOMINGTON, ILL.—Union Gas & Electric Company has increased its capital from $1,000,000 to $1,100,000.

EAST MOLINE, ILL.—The Central Union Telephone Company will make extensive improvements in the telephone system.

STREATOR, ILL.—The United States Coal and Coke Company of Chicago, of which W. B. Cummings is president, has purchased from Charles Gibson the third vein mine property of the Rutland Coal Company at Rutland, south of Streator. There is one mine and 1,500 acres of coal included in the sale.

DETOUR, MICH.—C. W. Needham, of the Needham Electric Company, Escanaba, has contract for installing electric light plant here; also for erecting street lights and wiring a large number of business places and residences.

MUSKEGON HEIGHTS, MICH.—Consumers Power Company has started work on an addition to its local substation, which will contain several of the largest transformers in the state. Local industries have doubled, thus pressing the company for a double supply of electric current.

GRAND RAPIDS, WIS.—Natwick Electric Company with lowest bid, $8049, secured the contract for white way here. It will extend from St. Paul depot on west side to library building on east side and work is to be completed by Dec. 15 this year.

LAKE GENEVA, WIS.—Lake Geneva Water & Light Commission will install a new modern and efficient electric pumping equipment for the city for $6200. The equipment will consist of one deep well pump, with a capacity of 700 gallons per minute and two horizontal hill pumps capable of 500 gallons per minute. Electric motors of proper horsepower are included. Estimated cost of pumping with electric power is much less than at present with antiquated pumps and power in use.

MILWAUKEE, WIS.—Park Board will install lighting systems in Humboldt, Kosciusko, Mitchell and Washington Parks, similar to that in Lake Park. D. B. Starkey president of park commissioners.

SHAWANO, WIS.—Contract for additions and improvements to municipal electric light and waterworks plant has been let to DeLos Engineering & Construction Company, of Prairie du Chien. The building to be erected will be 66x115 feet and have a floor capacity for generating 1500-horsepower current. New machinery, including a new engine and generator and two electrically driven pumps will be installed this fall.

SAUK CENTER, MINN.—Sauk Center is now generating in a municipal power plant the electricity supplied to its citizens. The new plant consists of two 140-horsepower horizontal Diesel crude-oil engines, with 85-kilowatt, 2300-volt generators directly connected to their shafts. The twin set of pumps has a capacity of 400 gallons each per minute, with a 150-foot head and 1450 revolutions per minute.

ST. PAUL, MINN.—Mayor Irvin has received an engineer's report on the proposed municipal electric power and lighting plant. The erection of a 60-foot dam and power plant on the St. Croix river 60 miles from St. Paul is suggested. It is estimated to cost $1,000,000.

WALKER, MINN.—Franchise has been granted to M. D. Stoner and T. H. Croswell for the construction of an electric light and power plant.

DUBUQUE, IA.—The Eastern Iowa Electric Company has petitioned the Board of Supervisors for franchise to build transmission lines from Dubuque to Dyersville, New Wine, Luxemburg and Holy Cross.

FORT DODGE, IA.—Fort Dodge Electric Company's franchise will be voted on Oct. 15; also the prohibitory amendment will be voted on that date.

READLYN, IA.—Franchise has been granted to Tegtmeier Bros. for the construction of an electric light and power plant.

WAVERLY, IA.—It is proposed to raise $15,000 for light and water utilities by the sale of bonds.

CRANE, MO.—Crane Telephone Company has been acquired by John Wells, of Springfield.

ST. LOUIS, MO.—Union Electric Light & Power Company, a subsidiary of North American Company, has asked permission to issue $1,000,000 7 per cent stock, to reimburse company's treasury for money expended on improvements.

ALDEN, KANS. — The question of electric lights for Alden is being discussed. A committee has been appointed to investigate the cost to the city and to individual users.

BELOIT, KANS. — The city of Beloit has under consideration a proposition from the Concordia Electric Light Company to furnish current for the city.

DODGE CITY, KANS. — Owing to failure of the franchise for the light plant the company abandoned its plan of taking over the Kinsley plant and constructing a transmission line to towns of Wright, Offerle, Kindley, Lewis and Belpre. Contract for the Kinsley plant was dependent upon the result of the election.

GARFIELD, KANS.—A proposition is being promoted to get electric lights here.

LURAY, KANS. — At a special meeting of the council held recently the city purchased the Electric Light plant of M. L. Bratton and same will be improved and enlarged by the addition of a new and larger engine.

NORWAY, KANS. — A meeting of the citizens of Norway and representatives of the Concordia Electric Light Company was held recently to consider the proposition of lighting the town of Norway.

PROTECTION, KANS. — The electric light plant burned Sept. 13th, with a loss of $25,000. City has voted bonds for a new plant.

RIVERTON, KANS.—Empire District Electric Company will build a substation and make general improvements in its plant, which is the first step to make Baxter Springs the supply station for light and power for the mines south and southwest of the city. The company is replacing three old engines with new motors and a transformer is being installed to transform electricity from the plant here to Baxter Springs.

TOPEKA, KANS.—City has ordered special illuminating to be installed on Kansas avenue between Tenth and Eleventh streets.

WICHITA, KANS. — Wichita - Walnut Valley Interurban Railway Company, which was recently incorporated with a capital of $2,000,000, will build an electric railway from Wichita to El Dorado, thence to Augusta, Douglass, Rock and on to Winfield, where it will connect with Arkansas City-Winfield interurban.

DUNBAR, NEB.—Town has voted $7000 bonds for establishing an electric light system.

ISABEL, S. D.—Installation of an electric lighting plant is being considered.

SOUTH CENTRAL STATES.

FLEMING, KY. — Cornettsville Coal Company contemplates establishing a power plant. J. W. Montgomery is president.

FRANKFORT, KY.—Frankfort-Shelbyville interurban line will be built. Two routes are under consideration, one along the Louisville pike and the other by way of Bagdad. A representative of Phillip & Beach, construction engineers of Philadelphia, interested in interurban building, has made a thorough survey of the two routes contemplated.

LEBANON, TENN.—City commission has ordered a vote on Oct. 6 on $25,000 bonds to acquire the Lebanon Light & Power Company's light, water and power plant.

MEMPHIS, TENN.—Yazoo & Mississippi Railroad Company is planning for the erection of a new power plant in the vicinity of Greenwood, Miss. A. H. Egan is general superintendent.

BIRMINGHAM, ALA.—Matthews Electric Supply Company has increased its capital from $35,000 to $100,000. H. W. Matthews is president of the company and C. R. Matthews, secretary and treasurer.

MONTGOMERY, ALA. — Montgomery Light & Traction Company plans to build substation equipped with five high capacity rotary converters and accompanying equipment.

WESTWEGO, LA.—Leo A. Marrero, of Gretna, La., plans the organization of a company to build an electric lighting plant and water works.

DATES AHEAD.

American Electrochemical Society. Annual convention, Pittsburgh, Pa., October 3 to 6. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

National Electrical Contractors' Association of the United States. Annual convention, New Orleans, La., October 10 to 13. Secretary, H. C. Brown, Utica, N. Y.

The Jovian Order. Annual convention, Hotel McAlpin, New York City, October 22-23. Mercury, Ell C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Electrical Committee, National Fire Protection Association. Adjourned annual meeting, New York City, October 23-24. Secretary, Ralph Sweetland, 141 Milk Street, Boston, Mass.

National Electric Light Association, Southeastern Section. Annual convention, Birmingham, Ala., October 24 to 26. Secretary, T. W. Peters, Columbus, Ga.

SCOOBA, MISS. — Town Council is planning for the installation of a new electric-lighting system.

OZARK, ARK.—Improvements to cost about $150,000 are to be made at an early date by the Citizen's Service Company on its plant here.

BLACKWELL, OKLA.—Lightning struck the lighting plant and a new $15,000 engine was shattered here Sept. 7.

MACOMB, OKLA.—The Equity Telephone Company chartered with a capital stock of $16,000, by R. W. Johnson, W. A. Young and M. L. Stice, all of Macomb.

MIAMI, OKLA. — Matter of $200,000 municipal bonds will be taken up in the near future. If same carry, $45,000 will be apportioned to an extension of the Electric Light and Power service; $45,000 to improving the water system; $80,000 for storm sewers; $20,000 for sanitary sewers.

WOODWARD, OKLA.—Ft. Supply Telephone & Telegraph Company has increased its capital stock from $50,000 to $75,000.

FAIRY, TEXAS. — Fairy Telephone Company chartered with a capital stock of $300 by Ernest R. Rudaley, Ben Gleason, J. H. Davis and others.

WESTERN STATES.

TERRY, MONT.—Council has ordered installation of electric lighting systems in city.

CARSON CITY, NEV.—Nevada Valleys Power Company, which has announced plans for the erection of a $300,000 hydroelectric plant on Truckee River and transmission lines covering a large section of western Nevada, has secured a franchise for the construction of its power plant.

COLVILLE, WASH.—Northport Power & Light Company has asked for a franchise for an electric transmission line from the international boundry line to the city of Northport.

SEATTLE, WASH. — Arrow Electric Company was awarded contract for changing Division "A" of the municipal street railway system from a double to a single trolley at $5220.

SEATTLE, WASH.—Sealed bids are being received by city comptroller for purchase of $300,000 light and power plant bonds, maturing in equal series, from 6 to 20 years.

SEATTLE, WASH.—Bill of Councilman O. T. Erickson, authorizing issuance of street railway utility bonds for purchase of Loyal Heights line, owned by Harry W. Treat in Ballard, or the paralleling of that line, has been passed. The engineering department has estimated cost of extending the city's Division A from its present terminus at Thirteenth avenue West and Thorndike avenue, across Ballard bridge to Leary avenue and Market street at $28,542. For this extension council has authorized a loan of $25,000 from the light fund. It is estimated that cost of extension from Market street and Leary avenue to north city limits, along streets occupied by Loyal Heights line will be close to $100,000.

ASTORIA, ORE.—Matter of extending the street car line to the McEachern Ship Company's yards, and to the plant of the Astoria Pulp & Paper Company at a cost of about $20,000 is being considered.

PENDLETON, ORE.—City council has made new street lighting contract with Pacific Power & Light Company for a period of five years.

PORTLAND, ORE.—Pacific Power & Light Company has leased for itself and for its subsidiary companies the Portland Gas & Coke Company and the Walla Walla Railway Company, the four lower floors of the Henry Failing Estate Building at Fifth and Alder streets.

AZUSA, CAL.—United Light & Power Company is planning the installation of a plant that will cost about $500,000 and will provide 6000 kilowatts.

BARSTOW, CAL.—Southern Sierras Power Company will begin at once the construction of a new transmission line west from this place, a distance of 41 miles, at a cost of $115,000.

LONG BEACH, CAL.—An ordinance of intention has been adopted for installing lighting standards of reinforced concrete.

LOS ANGELES, CAL.—Pacific Electric Company will expend $140,000 on improvement of Santa Monica-Sawtelle line of its electric railway system.

LOS ANGELES, CAL.—Pacific Telephone & Telegraph Company has appropriated $200,000 for improvements in southern California, as follow: Glendale central office, $77,410; copper circuit between Campo and El Centro, $38,020; copper circuit between San Diego and Campo, $30,080; trunk cables between Ocean Beach and San Diego, $15,090; improvements at Orange, $9200; pole lines between Los Angeles, Whittier and Artesia, $9240; re-routing line between Redondo and Redondo Junction, $7150; work at Ocean Beach, $3880; poles and cables at Orange, $1430; remodeling plant at Ocean Beach, $2360; work on Bakersfield line, $2330; circuits between Torrance and Los Angeles, $2110; cable work at Brawley, $670; magneto switchboard at Calexico, $570, and other minor work.

LOS ANGELES, CAL.—Western Union Telegraph Company has taken over the telegraphic service along the line of the Tonopah and Tidewater Railroad.

PITTSBURG, CAL. — Great Western Power Company has bought 14 acres of the Muir estate, where it has started excavating for one of the largest outdoor type substations in the west. The expenditures will reach $100,000.

SAN DIEGO, CAL.—San Diego Consolidated Gas & Electric Company announces expenditures totaling $687,000 for year which began July 1, 1917. Of this $284,000 will be used for extending company's electric power lines to San Juan Capistrano to connect with hydroelectric line of Southern California Edison Company, of Los Angeles. The company has applied for permission to issue bonds to amount of $1,000,000.

SAN FRANCISCO, CAL.—Pacific Telephone & Telegraph Company has appropriated $59,920 for additional phantom circuit between Sacramento and Stockton, Cal., and for improvements in the Stockton-Fresno division.

SAN FRANCISCO, CAL.—Visalia Electric Railroad Company has been authorized to build tracks near the southerly boundary line of Lindsay.

SAN FRANCISCO, CAL. — Yosemite Power Company has been authorized to sell to Sierra & San Francisco Power Company for $450,000, plus the cost of additions and improvements from Dec. 1, 1916, its electric production, transmission and utility business known as the La Grange Division.

STOCKTON, CAL.—It is announced that an electric smelting plant will be built at Bay Point, Cal., by the Pacific Electro Metals Company, of which C. D. Clark is president. Project is financed by Stockton men, among them being C. D. Clark, manager of California Navigation & Transportation Company; J. M. Kroyer, of Samson Sieve Grip Tractor Company; J. H. Hough, president of First National Bank, Stockton.

WATSONVILLE, CAL.—Coast Counties Gas & Electric Company has made a proposition to expend $5000 in installing 142 lights if the city will pay the monthly bill for current. It is planned to install 80 80-watt lights, 37 100-watt lamps and 25 of the 250-watt variety.

Service.

Only those who have been "on the inside" can know the tremendous influence which an efficient business paper wields nowadays in shaping the course of events within its own industry. Very much of the work done by such a journal never appears within its pages at all, but is rendered as supplementary advice and assistance in personal instances, and this service is very frequently comparable, both as to character and extent, to that rendered by a doctor or lawyer to patient or client. Even when this is not the case, and the results of investigation carried on or reports of data gathered are published in the pages of the periodical, the reader gets facts which are vital to the well-being of his industry, and gets them at the purely nominal expense of his subscription, though if collected for his individual use alone, or under his own direction, the gathering of such material might have cost hundreds of dollars. The relation between subscriber and publication is in fact getting so close and direct, in the business paper field (as well as in others) that there is a well-defined tendency for the trade publication to become a sort of business forum, or public meeting place where all interested persons may make their contribution to the good of the cause in general.

PROPOSALS

ELECTRICAL SUPPLIES.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., has asked for bids for the following supplies under schedules given herewith: Miscellaneous rubber-insulated, lead-sheathed lighting and power cable; miscellaneous incandescent-lamp cord; miscellaneous rubber-insulated lighting and power wire; 220 pounds slow-burning, solid, triple-braid underwriters' wire; miscellaneous weatherproof triple-braid wire, delivery at Mare Island, Cal., schedule 1484, and miscellaneous interior communication rubber-insulated cable; 300 feet rubber-insulated, flexible brush holder cable; 60,000 feet silk-covered bell cord; 15,000 feet double-conductor telephone cord; 2300 feet single-conductor lighting and power wire; 3000 feet twin-conductor, leaded-armored lighting and power wire, delivery at Mare Island, Cal., schedule 1485.

POST OFFICE BUILDINGS.—Supervising Architect, Treasury Department, Washington, D. C., is inviting sealed bids for the construction of post office buildings at the following places, date of opening of bid being given in each case: At Andalusia, Ala., bids opened Oct. 23; Bad Axe, Mich., Oct. 12; Bakersfield, Cal., Oct. 24; Mount Carmel, Ill., Oct. 26; Waterloo, Iowa, Oct. 29; Waynesboro, Va., Oct. 15. Drawings and specifications may be obtained at the office of James A. Wetmore, acting supervising architect, Washington, D. C.

LIGHTING FIXTURES. — Supervising Architect, Treasury Department, Washington, D. C., will receive sealed proposals until Sept. 28, for furnishing and installing interior lighting fixtures in the United States appraisers' stores at Boston, Mass. Drawings and specifications may be obtained at the office of James A. Wetmore, acting supervising architect, Washington, D. C.

POWER HOUSE.—Bids will be received until 11 a. m., Oct. 2, by United States Engineer for building fireproof power house at dam No. 24, Ohio River.

REFRIGERATING PLANT.—Supervising Architect, Treasury Department, Washington, D. C., is inviting sealed bids for a refrigerating plant in the United States Marine Hospital at Key West, Fla., bids opening Sept. 28. Copies of specifications may be obtained at Custodian's office, or at the office of James A. Wetmore, acting supervising architect, Washington, D. C.

INCORPORATIONS

DOVER, DEL.—Animated Bulletin Company. Capital, $100,000. To manufacture electric signs, etc. Incorporators: Richard M. Craig, San Antonio, Tex.; Frank W. Arford and Charles A. Murphy, both of Chicago, Ill.

CHICAGO, ILL. — Mississippi Valley Telephone Company. Incorporated in Delaware with capital of $100,000. To construct and operate telephone systems. Incorporators: B. F. Kimball, R. B. Hall and A. L. Epstein, all of Chicago.

LEBANON, MO.—The Missouri Water Power and Electric Company chartered with a capital stock of $300,000. The directors are J. C. Settle, S. R. Price, Guy R. Stanton and J. B. Quigley.

Electrical Patents Issued September, 4 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,238,739. Illuminated Display Apparatus. F. C. Bowdidge and P. C. McMullen, Albany, N. Y. Has a motor-driven reflector creating optical illusion of flag flying.

1,238,748. Multi-Exchange Telephone System. H. D. Currier and R. I. Utter, assignors to Kellogg Switchboard & Supply Co., Chicago, Ill. Arrangement of circuits.

1,238,753. Handle for Battery-Boxes and Means for Locking Same. B. Ford, Philadelphia, Pa. Structural details.

1,238,754 and 1,238,755. Secondary or Storage Battery. B. Ford, Philadelphia, Pa. Structure and mounting of plates and separators in a container.

1,238,768. Insulator. G. C. Hill, Victor, N. Y. Suspension type.

1,238,772. Railway-Signal. R. F. Hudson, assignor to Hudson Railway Signal Co., Inc., Richmond, Va. Electromagnetic mechanism for operating signal.

1,238,776. Thermostatic Trip-Switch Device. J. Jackson, assignor to Globe Stove & Range Co., Kokomo, Mich. Structural details.

1,238,784. Grinding-Mill. W. J. Keary, Schenectady, N. Y. Driving motor is controlled by supply and withdrawal of material.

1,238,792. Electric Hot-Plate or Heat Unit. M. E. Louth & J. Jackson, assignors to Globe Stove & Range Co., Kokomo, Ind. Manner of mounting resistor.

1,238,793. Electric Heat-Storage Heating Unit. M. E. Louth & J. Jackson, assignors to Globe Stove & Range Co. Manner of mounting resistor.

1,238,799. Connector for Flexible Armored Conductors. L. Marchand, Jr., Pittsburgh, Pa. Structural details.

1,238,807 and 1,238,808. Electric-Hot Plate or Heating Unit. J. C. Patten, assignor to Globe Stove & Range Co. Mounting and insulation of resistor.

1,238,811. Cable-Socket. J. A. Phillips, Drumright, Okla. Structural details.

1,238,816. Holder for Tail-Lights and Number Plates for Automobiles. E. E. Poole, Boston, Mass. Details of construction.

1,238,823. Protective Burglary-Alarm for Buildings, Etc. P. Roeder, Brooklyn, N. Y. Alarm circuit controlled by screen-like conductor.

1,238,845. Locking-Switch. P. C. Thoner, Everett, Mass. High potential knife switch for mounting on wall or ceiling, has latch for securing it, closed and disengageable by eye in which hook end of hole may be inserted.

1,238,848. Highway Signaling Apparatus. E. W. Vogel, assignor to Chicago Railway Signal & Supply Co., Carpentersville, Ill. Electrically operated and illuminated visible and audible danger signal.

1,238,849. Lamp-Socket. G. W. Wacker, assignor to National Carbon Co., New York, N. Y. Structural details.

1,238,850. Portable Electric Light. G. W. Wacker, assignor to National Carbon Co., New York, N. Y. Tubular flash light.

1,238,868. Electric-Lighting Apparatus. C. Wirt, assignor to Wirt Co., Phila., Pa. Regulable lamp cluster.

1,238,869. Valve-Receiver for Wireless Signals. G. M. Wright, assignor to Marconi Wireless Telegraph Co., New York, N. Y. Structure and arrangement of electric valve.

1,238,885. Junction-Box. A. Chmela, assignor to Splitdorf Electrical Co., Newark, N. J. Manner of insulating cable point.

1,238,887 and 1,238,888. Railway Traffic Controlling Apparatus. J. P. Coleman, assignor to Union Switch & Signal Co., Swissvale, Pa. Electro pneumatic apparatus.

1,238,896. Automatic Regulator for Combined Dynamo and Storage Battery Circuits. A. E. Doman, assignor to Dyneto Electric Corp., Syracuse, N. Y. Vehicle lighting system.

1,238,911. Sheet-Metal Form for Armature-Coils. W. T. Hensley, assignor to Bound Brook Engine & Mfg. Co. Structural details.

1,238,921. Spool Construction. F. Johannsmeyer, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. For coils.

1,238,922. Rail-Contactor. E. C. Johnson, Los Angeles, Cal. Operated by movement of railway rail.

1,238,923. Dynamo-Electric Machine. C. L. Kennedy, assignor to Holtzer-Cabot Electric Co., Roxbury, Mass. Structure of machine with armature having direct and alternating current windings.

1,238,936. Transparent License-Tag and Holder. H. W. Paynter, assignor of one-half to H. A. Paynter, Phila., Pa. For automobiles.

1,238,937. Signaling Device. F. B. Perry, Newton Center, Mass. Portable device having key operated visual and audible signals.

1,238,948. Apparatus for Operating Flashlights. H. V. Sheppard, Worcester, Mass. Details of electromagnetically vibrated contactor.

1,238,959. Terminal-Bending Tool for Armatures. E. J. Tomlinson, assignor to V. G. Apple, Dayton, Ohio. Structural details.

1,238,975. Signaling Apparatus. H. R. Worthington, Dunfield, N. J. Electrically operated sound producing device with oscillating megaphone.

1,238,990. Self-Cleaning Spark-Plug. W. H. Cotton, assignor to Old Dutch Mfg. Co., Huron, S. D. Structural details.

1,239,005. Incandescent-Lamp-Attaching Member. A. L. Harris & E. F. Casanova, San Francisco, Cal. A one-piece shell for attaching a lamp base to a socket.

1,239,008. Electromagnetic Winding. C. T. Henderson, assignor to Cutler Hammer Mfg. Co. Warmer of insulation to facilitate impregnation.

1,239,011. Automatic Telephone-Exchange System. C. A. W. Holtman,

No. 1,238,799.—Connector for Armored Cable.

Stockholm, Sweden. Arrangement of automatic selective switching means.

1,239,012. Electrolytic Cell. N. V. Hybinette, Christiania, Norway. For depositing copper from sulfate solutions.

1,239,037. Advertising-Machine. H. E. Phelps, B. T. Kirk and J. Comstock, Rifle, Colo. Electrically illuminated changeable signs.

1,239,038. Semi-Indirect-Lighting Device. A. S. Powell, New York, N. Y. Manner of supporting shade and diffusing bowl.

1,239,048 and 1,239,049. Railway Signal System. P. J. Simmen, Indianapolis, Ind. Signals on vehicle are operated through third rail.

1,239,054. Electric Push-Button. W. Sparks, assignor to Sparks, Withington Co. Structural details.

1,239,056. Electric Motor. W. Sparks, assignor to Sparks-Withington Co. Relates to brush holders.

1,239,057. Bearing for Shafts. W. Sparks, assignor to Sparks-Withington Co. For use in motor operated horns.

1,239,062. Locking-Switch. P. C. Thoner, Everett, Mass. Pole operated, latched knife switch.

1,239,078. Flash-Light. B. Benedict, assignor to Beacon Miniature Electric Co., Inc., New York, N. Y. Pocket structure like watch.

1,239,093. Traffic-Directing Signal for Vehicles. C. G. Ette, St. Louis, Mo. Interiorly illuminated, rotatable sign cylinder.

1,239,097. Telephone System. G. Grabe, assignor to Siemens & Halske, A. G. Berlin, Germany. Automatic system for ordinary and preferred service lines.

1,239,108. Cable-Hanger. J. Kennedy, assignor to Clements Co., N. Y., N. Y. For suspending cable from messenger.

1,239,114. Circuit-Breaker. F. H. Kroger, assignor to S. M. Kintner & H. M. Barrett, receiver for National Electric Signaling Co., Pittsburgh, Pa. Structure of electromagnetic switch.

1,239,121. Spark-Plug for Explosive-Engines. M. T. Minogue, Phila., Pa. Details of construction.

1,239,140. Fire-Alarm Apparatus. A. Torchio, Oyster Bay, N. Y. Structure of fuse controlled circuit closer.

1,239,141. Electric Sigaling Apparatus. F. S. Tucker, Boston, Mass, assignor one-half to E. P. Severance, Brockton, Mass. Selective, code signal transmitter.

1,239,142. Cross-Arm. E. C. Van Diest, assignor to Associated Engineers Co. Built up of angle metal.

1,239,145. X-Ray Apparatus. J. B. Wantz, assignor to Victor Electric Corp., Chicago, Ill. Means for supporting and manipulating X-Ray apparatus.

1,239,146. X-Ray Table. J. B. Wantz, assignor to Victor Electric Corp. Structural details.

1,239,182. Mounting-Shell for Incandescent Electric Lamps. E. W. Henger, assignor to Waterbury Mfg. Co., Waterbury, Conn. Mounting fixture for standard lamp sockets.

1,239,199. Switch-Lock. B. H. McNeil, Chicago, Ill. Requires certain relative positions of contact disks to establish connections.

1,239,205. Telephone-Exchange System. T. E. Meyer, assignor to Automatic Electric Co. Automatic, party-line system.

1,239,207. Automatic Telephone System. G. E. Mueller, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Structure and arrangement of line selectors.

1,239,214 and 1,239,215. Electric Furnace. B. F. Price, assignor to Electro Metallurgical Co., New York, N. Y. First patent: hearth structure. Second patent: details of flexible electrode connection.

1,239,219. Motor-Vehicle. G. B. Ridley, San Francisco, Cal. Inter-relation of motor controller and friction brake.

1,239,236. Electric-Circuit Closer for Automobiles. G. F. Voight, San Francisco, Cal. For mounting on steering wheel of automobile.

1,239,243. Hole-Plug for Junction-Boxes and Similar Structures. C. Wuensch, assignor to Frank Adam Electric Co., St. Louis, Mo. Structural details.

1,239,249. Rectifier for Alternating Currents. E. C. Ballman, Kirkwood, Mo. Arrangement comprising a magnetic vibrator.

1,239,257. Electrically-Heated Seam-Rubber. E. N. Chandler, assignor to Boston Last Co., Boston, Mass. For smoothing boot and shoe parts.

1,239,258. Automatic Switching Device. R. V. Cheatham, and E. S. Olmsted, assignors to Cheatham Electric Switching Device Co., Louisville, Ky. Trolley controlled.

1,239,275. Control-Switch for Electric Lamps. E. Keen, assignor to W. P. Dunham, New York, N. Y. Two-push-button snap switch.

1,239,292. Safety-Lock for Switch Plugs or Keys of Motor-Vehicles. R. L. Mundell, Albion, Iowa. Coil box switch lock.

1,239,317. Lamp-Socket. G. B. Thomas, assignor to Bryant Electric Co., Bridgeport, Conn. Of the Edi-Swan type.

1,239,320. Apparatus for Detecting Subaqueous Sounds. F. Van Esbroeck, assignor to E. M. Cranston, Southsea, England, and A. Paull, Kingswood, England. Submerged air chamber acts on microphone.

1,239,322. Electric Thermal Cut-Out Device. L. Vecchio, Albany, N. Y. Structure of fuse plug.

1,239,325. Electric Water-Heater. E. C. Webster, assignor one-half to H. Gruenhagen, Oakland, Cal. Mounting and insulating in tubular structure, of electrodes for passing current through water.

1,239,335. Automatic Stop for Talking Machines. L. R. Armitage, East Orange, N. Y. Detailed arrangement for controlling driving motor circuit by tone arm.

1,239,339. Maximum Demand Indicator. J. T. Beechlyn, assignor to General Electric Co. A member intermittently turned to maximum demand position by a watt hour meter is prevented from return to initial position on cessation of current.

1,239,344. Electrical Gun. L. M. Bowman and W. A. Smith, Tulsa, Okla. Electrical apparatus in stock for igniting explosive is controlled by trigger.

1,239,357. Relay. H. D. Currier and L. Ericson, assignors to Kellogg Switchboard & Supply Co. Structure of device for telephone lines.

1,239,381. Signaling System. J. C. Francis, assignor to Samson Electric Co. Has a general alarm circuit, an auxiliary signaling circuit and a control circuit.

1,239,383. Fire and Rain Alarm. G. M.

Gebhard, Rochester, N. Y. Destructible means holds contacts apart.

1,239,413. Incandescent Lamp. G. M. J. Mackay, assignor to General Electric Co. Form and suspension of filament.

1,239,420. Battery-Element Puller. M. Melia, assignor to Commercial Truck Co. of America, Philadelphia, Pa. For removing plates from storage cells.

1,239,443. Apparatus for Electrolytic Deposition. F. L. Antisell, Perth Amboy, N. J. Special anode structure.

1,239,450. Electric Alarm. J. Banneyer, Chicago, Ill. Signal for indicating heated bearings.

1,239,464. Section-Switch. H. W. Davis, Swissvale, Pa., asisgnor one-half to W. C. Frost, East Pittsburgh, Pa. For insertion in trolley line.

1,239,477. Mode of Protecting Storage Structures from Lightning. J. M. Gordon, Eureka, Kans. For use on portable storage tanks.

1,239,493. Desk or Table Lamp. G. Lampert, New York, N. Y. Standing lamp comprising mirror movable into and out of cavity in base.

1,239,507. Electric Clock. E. Kling-Muller, Philadelphia, Pa. Structure having impulses imparted to the pendlum by an electromagnet.

1,239,512. Accumulator Cell. L. J. Perry, assignor to Vesta Accumulator Co., Chicago, Ill. Manner of spacing and insulating the plates.

1,239,515. Machine for Ozonizing Air. A. Peterson, Newark, N. J. Manner of circulating and mixing the air.

1,239,530. Electrolytic Apparatus. H. T. Shriver, West Orange, N. J. Manner of supplying diluent to the electrolyte.

1,239,531. Connector. J. F. Smart, assignor to Landers, Frary & Clark, New Britain, Conn. Manner of securing flexible conductors to a divided plug casing.

1,239,541. Variable-Speed Transmission Mechanisms for Automobiles. W. K. Thomas, Brooklyn, N. Y. Electromagnetically controlled planetary gear system.

1,239,556. Lighting-Fixture. G. M. Beardslee, assignor to Beardslee Chandeller Mfg. Co. Socket inclosing structure for supporting a shade and light diffusing bowl.

1,239,569. Electrically-Controlled Releasing Means. J. P. Crandall, Buffalo, N. Y. Electromagnetically operated.

1,239,587. Measured-Service Telephone System. R. C. Gifford, assignor to Automatic Electric Co., Chicago, Ill. Details of call registering apparatus.

1,239,588. Rectifier for Alternating Electric Currents. C. Gilbert, Bridgeport, Ohio, and E. J. Ornold, Wheeling, W. Va., assignors of one-third to R. Stalmaker, Wheeling, W. Va. Commutating apparatus.

1,239,592. System of Multiple Control. J. H. Hammond, Jr., Gloucester, Mass. Circuit control is effected by wireless impulses.

1,239,594. Heat-Regulator. L. H. Harlow, assignor to Minneapolis Heat Regulator Co., Minneapolis, Minn. Thermostatic control of alternating current heater.

1,239,602. Alarm Device for Motor-Vehicles. B. F. Johnston, assignor one-half to W. B. Mowbray, Ogden, Utah. Controlling switch mounted on steering shaft and operated thereby.

1,239,607. Telephonic Paging System. N. A. Kurman, assignor to International Callophone Corp., New York, N. Y. Arrangement of loud speaking stations and central transmitting station.

1,239,609. Electric Control Apparatus for Musical Instruments. F. B. Little, Indianapolis, Ind. Arrangements for illuminating the instruments and playing several from one keyboard.

1,239,647. Ventilating System for Car-Motors. W. E. Ver Planck, assignor to General Electric Co., Schenectady, N. Y. Motor driven by gasoline engine through generator has ventilating air circulated through it by suction through carbureter.

1,239,654. Electrical Apparatus. R. B. Williamson, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Relates to ventilation of coils and cores of dynamo electric machines.

1,239,672. Signal Device for Speed Indicators. H. Dahl, Wilmersdorf, Berlin, Germany. Speed indicated by change in color and variation in intensity of light.

1,239,673. Blast Device for Shoe-Polishing Machines. G. E. delos Monteros, El Paso, Tex. Motor driving polisher also drives fan directing blast on shoe.

1,239,697. Electric Connection for Automobile Lamps. J. G. Kearby and Z. Robinson, Mineral Wells, Tex. Insulating plug for mounting lamps in headlights.

1,239,702. Telephone for Long Distances or for Deaf Persons. R. Lagus, Abo, Finland, Russia. Means for rendering a telephone applicable for varying distances.

1,239,710. Electrical System of Distribution. A. McGary, assignor to Gould Coupler Co. Generator and battery car lighting system.

1,239,718. Cover-Locking Means. C. D. Platt, Bridgeport, Conn. For sheet metal switch box.

1,239,720. Carbon-Feeding Mechanism. W. G. Preddey, San Francisco, Cal. For arc lamps.

1,239,723. Submarine Boat. E. B. Reilly, assignor four-fifths to H. R. Young, Atlantic City, N. J. Has an electrolysis device connected with the combustion chamber of the boiler.

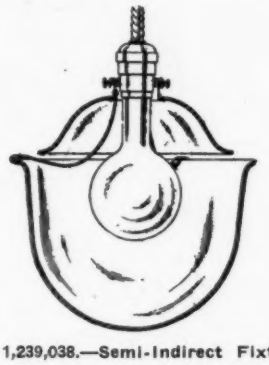
1,239,731. Separable Supporting and Polarity Attachment-Plug. M. H. Shoenberg, assignor to Majestic Electric Development Co. Details of construction.

1,239,759. Automatic Electric-Arc-Control Mechanism. H. M. Baker, Jr., assignor to A. Treadwell, Jr., Brooklyn, N. Y. Gearing for operating elecrodes by hand.

1,239,761. Alternating-Current Motor. A. C. Bell and T. R. Bell, Westfield, N. J. In starting, special structure short circuits commutator and starting is assisted by a light squirrel cage.

1,239,772. Electric Regulation. J. L. Creveling, assignor to Safety Car Heating & Lighting Co. Generator and battery car lighting system.

1,239,777. Starting and Lighting System. J. B. Entz, assignor to E. L. Thurston, trustee, Cleveland, Ohio. For automobiles.



No. 1,239,038.—Semi-Indirect Fixture.

1,239,790. Combination-Lock for Electric Circuits. J. F. Hendrickson, Wollaston, Mass. Contacts controlled by removable key; for preventing tampering wtih automobiles.

1,239,795. Protective Device. E. O. E. Klipphahn, Dobbins, Cal. For opening the circuit on unbalanced conditions in the field.

1,239,810. Arc-Lamp Electrode. W. R. Mott, assignor to National Carbon Co., Inc. Contains lithopone, fluorids and a precipitate of barium sulfate and zinc sulfid.

1,239,822. Process for the Manufacture of Aromatic Amino-Oxy-Compounds. A. Piguet, E. Steinbuch and R. Stocker, assignors to Society of Chemical Industry in Basle, Basel, Switzerland. By electrolytic reduction of aromatic nitro compounds in acid.

1,239,830. Circuit-Closer. C. Sheldon, Saratoga Springs, N. Y. Structural details.

1,239,831. Wireless Telegraphy. F. G. Simpson, Seattle, Wash. Special transmitting arrangement including a three pole rectifier.

1,239,832. Traffic-Directing Signaling Device. C. A. Singer, assignor to Singer Auto Traffic Signal Co., St. Louis, Mo. Electrically actuated and illuminated.

1,239,833. Multiple Switch. C. A. Singer, assignor to Singer Auto Traffic Signal Co. Structural details.

1,239,835. Storage Battery and Method of Making Same. R. L. Smith, Everett, Mass. Manner of mounting cells in battery boxes.

1,239,837. Universal Control-Handle. L. B. Sperry, assignor to Sperry Gyroscope Co., Brooklyn, N. Y. Control device for aeroplanes for governing tilting of the plane.

1,239,840. Control System for Electric Motors. N. W. Storer, assignor to Westinghouse Electric & Mfg. Co. For railways; if master switch, controlling resistor switches, is moved backward a certain distance, the line switch opens.

1,239,841. Mercury Rectifier Distributing System. N. W. Stores, assignor to Westinghouse Electric & Mfg. Co. For electric railway systems.

1,239,852. Receiver of Electrical Impulses. F. K. Vreeland, assignor to Vreeland Apparatus Co., Inc., New York, N. Y. Wireless receiver for sustained high frequency signal impulses.

1,239,876. Electric Fuse. G. A. Burnham, Saugus, Mass. Formed of a plurality of fuse strips, some acting as short circuits for others and some as blow-outs.

1,239,887. Fire-Alarm Signal-Box. F. W. Cole, Newton Highlands, Mass. Details of transmitter.

1,239,890. Telephone-Stand. B. S. Cutler, assignor to Cutler Desk Co., Buffalo, N. Y. Engages with the base of a desk instrument.

1,239,896. Transformer. C. Le G. Forescue, assignor to Westinghouse Electric & Mfg. Co. Arrangement comprising a double-anode vapor converter.

1,239,902. Insulator. W. T. Goddard, Hamilton, Ontario, Canada. Manner of securing a conducting cap to an insulating pin.

1,239,934. Indicator for Vehicles. W. A. Miller, Los Angeles, Cal. Direction indicator having electric lamps on extensible arms.

1,239,949. Controlling Apparatus for Automobiles. J. H. Pace, Mansfield, Ga. Ignition circuit is opened by mechanism for holding clutch release pedal depressed.

1,239,979. Alternating-Current Motor. C. P. Steinmetz, assignor to General Electric Co. Single phase.

1,240,018. Alternating-Current Motor. S. R. Bergman, assignor to General Electric Co. Structure of secondary member of induction motor.

1,240,024. Automobile-Signal. S. L. Carpenter, assignor one-half to L. Karpen, New Rochelle, N. Y. Direction indicator.

1,240,049. Fire-Alarm. C. J. Jenne, San Francisco, Cal. Circuit of alarm is controlled by Bourdon tube in a sprinkler system.

1,240,067. Insulator and Cut-Out Switch. H. L. Lowe, assignor to Clinton Switch Co., Clinton, Ind. For insertion in a trolley line.

1,240,075. Signal Apparatus. E. Mayer and W. M. Correll, Ashland, Nebr. Electromagnetic apparatus selectively controls audible signals of different pitch.

1,240,076. Grid for Battery-Plates. R. S. Mears, Arkansas City, Kans. Structural details.

Patents Expired.

The following United States electrical patents expired on September 18, 1917:

657,908. Speed Regulator for Dynamos. P. W. Alexander, Tifton, Ga.

657,910. Metallic Cement for Electric-conductor Joints. W. F. Barber, Wilkes-Barre, Pa.

657,911. Apparatus for Separating Metals From Ores by Electricity. G. D. Burton, Boston, Mass.

657,953. Electric Meter. J. Harris, Lynn, Mass.

657,984. Electric Measuring Instrument. J. Harris, Lynn, Mass.

658,012. Dynamo-electric Machine. M. H. Hurrell, Wimbledon, England.

658,018. Coin-controlled X-ray Apparatus. F. Neugebauer, New York, N. Y.

658,022. Maximum-electrical-current Indicator and Recorder. E. C. Rimington, London, England.

658,064. Switch for Alternating Currents. B. Hopkinson, London, England.

658,075. Electric-railway System. W. Robinson, Boston, Mass.

658,100. Armature for Multopolar Dynamos. J. J. Wood, Fort Wayne, Ind.

658,117. Automatic Maximum-speed Governor for Electrically Propelled Vehicles. H. F. Parshall, London, England.

658,192. Electric Conductor. F. C. Sutter, Pittsburgh, Pa.

658,225. Circuit Controller. C. C. Webster. Asbury Park, N. J.

658,235. Secondary Battery. V. Cheval and J. Lindeman, Brussels, Belgium.

658,237. Electrical Warp Stopmotion for Looms. J. Coldwell and C. G. Gildard, Fall River, Mass.

658,238. Motor-vehicle. C. J. Coleman, Chicago, Ill.

658,239. Automatic Feed-water Regulator. C. J. Coleman, Chicago, Ill.

658,243. Trolley. W. A. Daggett, Vineland, N. J.

658,252. Signal. J. M. Sailer, Janesville, Wis.

658,299. Electric Gas-lighter. H. de Thiersant and H. J. Norballe, London, England.

658,301. Telephone Relay. W. G. Urmson. New Brunswick, N. J.

658,315. Electric Furnace. A. H. Cowles, Cleveland, O.

Financial News and Comment

A Boston banker who has intimate knowledge of street railway affairs in Massachusetts says: "The street railway crisis in the east is very real and very urgent. In this state it is rapidly approaching a stage of financial breakdown. The street railways of Massachusetts have today reached the point where further growth is impossible. Capital for their sustenance and expansion will not be furnished. So far as tractions are concern capital is on a strike. The only thing which will end the strike and bring capital back to street railway investments is giving the properties back to the managers whom the shareholders have elected to run them but who today under an unwise system of state regulation are denied the right to manage their properties. This is the nub of the whole street railway situation. The requested increases in fares are needed. But even if fares were to be raised to 10 cents, capital would not pour into these properties until the right of the real managers to manage was assured beyond question."

The California Railroad Commission has authorized the Yosemite Power Company to sell to the Sierra & San Francisco Power Company for about $450,000 its electric production, transmission and distribution of property and utility business known as the La Grange division. The property consists of a water right on the Tuolumne River, near Indian Bar, a water conduit 17 miles long, and a 900-kilowatt hydro-electric plant at La Grange, a transmission and distribution system, and the electric lighting and industrial power business in Stanislaus County.

The Lake Shore Electric Railway, operating between Cleveland and Toledo, has wired the State Utilities Commission it is out of coal and will have to suspend operations unless given quick relief. Chairman Hughes of the commission says steam roads will be ordered to divert enough coal to supply the electric line.

The Public Service Commission of Pennsylvania has granted the Duquesne Light Company of Pittsburgh, a subsidiary of Philadelphia Company, permission to issue $3,271,250 securities to provide for existing obligations and extensions.

The Newport News & Hampton Railway, Gas & Electric Company has filed notice of increase in its capitalization from $2,375,000 to $4,000,000 to provide for extensions and improvements.

Northwestern Electric Company, San Francisco, has declared quarterly dividend No. 10, of $1.50 per share, payable Oct. 1, on preferred shares outstanding as of record September 23, being at rate of 6 per cent. This company, besides having a number of power stations in California, has a hydroelectric plant on White Salmon River, Washington, from which its main transmission lines run to Portland, Ore. It has a large steam-electric standby station in sub-basement of Pittock Block, Portland.

The West End Street Railway Company recently sold to R. L. Day & Co. and Merrill Oldham & Co. an issue of $500,000 7% 30-year bonds. This is the second issue of 7% securities to be sold by the road within a few weeks, it having previously disposed of $1,581,000 three-year 7% notes to Lee Higginson & Co.

Utilities Securities Corporation declared the regular quarterly dividend of 1¾% on the preferred stock, payable September 27 to stock of record September 17.

Southwestern Cities Electric Company has declared the regular quarterly dividend of 1¾% on the preferred stock, payable October 1 to stock of record September 15.

Carolina Power & Light Company declared regular quarterly dividend of 1¾% on the preferred stock, payable October 1 to stock of record September 15.

Asheville Power & Light Company declared regular quarterly dividend of 1¾% on the preferred stock, payable October 1 to stock of record September 15.

Utah Gas & Coke Company declared regular quarterly dividend of 1¾% on the preferred stock, payable October 1 to stock of record September 20.

CONSUMERS POWER COMPANY.

	1917.	1916.
July gross	$ 443,626	$ 363,295
Net after taxes	219,587	204,588
Balance after charges	108,698	103,112
Seven months gross	3,199,885	2,622,193
Net after taxes	1,677,151	1,679,618
Balance after charges	924,946	973,406

DAYTON POWER & LIGHT COMPANY.

The comparative balance sheet of the Dayton Power & Light Company, Dayton, Ohio, on July 31, 1916, and July 31, 1917, is presented as follows:

Assets—	1917.	1916.
Property investment	$11,935,366.26	$10,473,344.62
Security investment	2,500.00	2,500.00
Construction fd.	659,040.84	1,250,000.00
Current assets.	248,417.31	241,070.67
Nominal assets.	6,054.00	4,094.50
Supply accts.	166,077.57	83,224.55
Prepaid accts.	110,134.60	114,425.91
Suspense accts.	1,408.12	1,506.26
Total	$13,128,998.70	$12,170,166.51
Liabilities—		
Funded debt	$ 4,879,000.00	$ 4,899,000.00
Current liabilities	890,511.33	183,206.01
Accrued liabilities	208,432.95	186,011.06
Coupons and div. matured.	6,054.00	4,094.50
Reserves	468,882.24	308,134.20
Capital stock — preferred	2,962,500.00	2,962,500.00
Capital stock — common	3,053,000.00	3,053,000.00
Surplus	660,618.18	574,220.74
Total	$13,128,998.70	$12,170,166.51

COPPER MARKET.

During the past week copper sales have been active, although market quotations remain at about 27 to 27.75 cents for lake and 26.50 to 27 for electrolytic. New York sales during the last ten days to domestic consumers amounted to 30,000,000 pounds, mostly for October delivery. Recent meetings of the Purchasing Committee of the War Industries Board are naturally being closely observed by copper producers and dealers, and an announcement of the price at which the Government will buy copper is anticipated any day. A figure between 22.50 and 25 cents is predicted. The Government now requires heavy supplies of the metal as war material for itself and allies and those supplies must be obtained, either at an agreed price or under a commandeering order wherein the Government will pay a price considered fair. One essential kept in view is that the price shall not be so low as to have the effect of restricting production.

Reports from Butte, Montana, are that the mines and smelter of Anaconda Copper Company are resuming operations, after having been closed down by strikes since August 24; and the International smelter, at Miami, Arizona, has again blown in its furnaces to handle the concentrates of the Inspiration and Miami mills at that place. The strike of employes of the United States mines and smelter at Kennett, Cal., has been settled and operations have been resumed.

The fact that copper production for the last half of this year may be 150,000,000 to 200,000,000 pounds less than that for the first six months, makes a situation around which centers the problem of price-fixing.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Sept. 11.	Bid Sept. 18.
Adirondack Electric Power of Glens Falls, common	..	16	16
Adirondack Electric Power of Glens Falls, preferred	6	68	68
American Gas & Electric of New York, common	10+extra	112	111
American Gas & Electric of New York, preferred	6	46	45
American Light & Traction of New York, common	..	277	266
American Light & Traction of New York, preferred	6	105	103
American Power & Light of New York, common	4	60	60
American Power & Light of New York, preferred	6	82½	82
American Public Utilities of Grand Rapids, common	..	28	28
American Public Utilities of Grand Rapids, preferred	6	63	62
American Telephone & Telegraph of New York	..	114½	116¼
American Water Works & Elec. of New York, common	..	6¼	5¾
American Water Works & Elec. of New York, particip	7	17	15
American Water Works & Elec. of New York, first preferred	..	65	64
Appalachian Power of Bluefield, common	..	2½	2½
Appalachian Fower of Bluefield, preferred	7	24	24
Cities Service of New York, common	c+extra	243	234
Cities Service of New York, preferred	6	83¾	82
Commonwealth Edison of Chicago	8	116½	116½
Comm. Power, Railway & Light of Jackson, common	4	47	47
Comm. Power, Railway & Light of Jackson, preferred	6	75	74
Federal Light & Traction of New York, common	..	10	10
Federal Light & Traction of New York, preferred	..	45	45
Illinois Northern Utilities of Dixon	6	77	77
Middle West Utilities of Chicago, common	2+2 extra	37½	39
Middle West Utilities of Chicago, preferred	6	68	66½
Northern States Power of Chicago, common	7	82	80
Northern States Power of Chicago, preferred	7	96½	96
Pacific Gas & Electric of San Francisco, common	5	51½	47
Pacific Gas & Electric of San Francisco, preferred	6	87	85
Public Service of Northern Illinois, Chicago, common	7	85½	86
Public Service of Northern Illinois, Chicago, preferred	6	96	95
Republic Railway & Light of Youngstown, common	4	31	31
Republic Railway & Light of Youngstown, preferred	6	63	63
Standard Gas & Electric of Chicago, common	..	8	7½
Standard Gas & Electric of Chicago, preferred	6	33	31½
Tennessee Railway, Light & Power of Chattanooga, common	..	4	4
Tennessee Railway, Light & Power of Chattanooga, preferred	6	25	24
United Light & Railways of Grand Rapids, common	4	36½	35
United Light & Railways of Grand Rapids, preferred	6	68	67
Western Power of San Francisco, common	..	12½	11
Western Power of San Francisco, preferred	6	54	52
Western Union Telegraph of New York	extra	89½	89½
Industrials—			
Electric Storage of Philadelphia, common	4	57	56
General Electric of Schenectady	8	138½	139
National Carbon of Cleveland, common	8	*78	70
National Carbon of Cleveland, preferred	..	*130⅝	130⅝
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	44⅝	44½
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	60	60

*Last sale.